INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

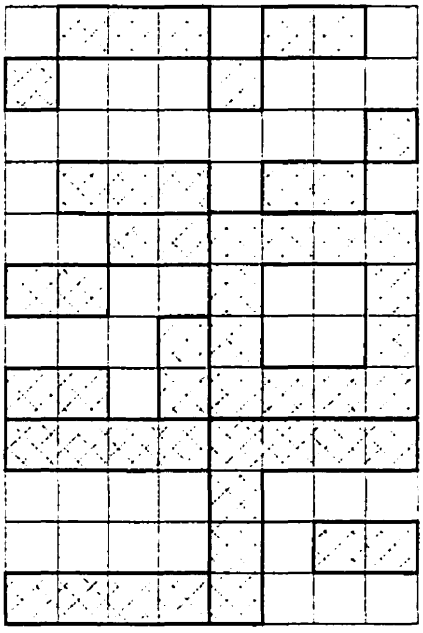
Space Between Buildings in Beijing's New Housing

Yue Li

School of Architecture
McGill University
Montreal

A Thesis Submitted to The Faculty of Graduate Studies and Research
in Partial Fulfillment of the Requirement for the Degree of
Master of Architecture

To my parents.....



Space Between Buildings in Beijing's New Housing

Acknowledgment

First of all, I am deeply indebted to my parents, who have not only helped me in collecting information from China but have also provided unconditional love and continuous moral support throughout my years of study abroad. This thesis is dedicated to them.

I would like to express my gratitude to Professor Vikram Bhatt, my advisor, for his intellectual criticism and enthusiasm during the development of this thesis. Thanks also to the staff of the School of Architecture, especially Marcia King, who has been always available where I needed help; Helen Dyer and Vanessa Reid, for their patience and delicate proof-reading works. I am grateful also for the Clifford C.F. Wong Fellowship; without it, I would not have been able to come to McGill.

My appreciation also extends to all those who have helped me by offering their friendship and support. In particular, thanks are due to my wife Yan who is always a source of inspiration and encouragement.

Abstract

In China, a standard of "relatively comfortable housing conditions" is set for the nation, but there is still a need for a parallel goal for outdoor spaces. So far, this issue has not received adequate attention from either the government or practitioners.

The purpose of this study is to examine the space between buildings in Beijing's new housing developments. The space between buildings has been chosen as a starting point for this research because it covers largest amount of land and due to its close proximity to homes, it is closely related to people's daily lives.

The quality of outdoor space is defined by a combination of factors. This study uses eight criteria to address the notion of quality: spatial hierarchy; usable space; safety and defense; health and comfort; privacy and territoriality; social contact; aesthetic appeal; and maintenance and administration. These correlated aspects are set as evaluation criteria for the six case studies included in this research. Data and analysis of case studies is used to arrive at conclusions for policy-making and further study.

Table of Contents

List of Figures

Note: Figures without references are from the author.

List of Tables

Note: Tables without references are from the author.

Introduction

Why Is Space Between Buildings an Issue

Since the economic reform policy was adopted in the late 1970's, China has undergone unprecedented transformations. The "Open Door" policy and economic development have affected almost every aspect of Chinese society, including the way people inhabit their houses and land. Rapid population growth, the process of urbanization, and chronic land shortages have caused a housing crisis in the last twenty years.

With a population of more than five million inhabitants in its urban area. Beijing is the second largest city in China. Since 1978, an average of 5-to-6 million square meters of housing was built each year in this city. This accelerated growth featuring large-scale, high density, housing built over a short period, resulted in the growth of a per capita living area[1] from 4.57 square meters in 1979 to 8.0 in 1991 (Wu, 1994, p.47; Fan, 1989, p.31). Nevertheless, problems are still far from being solved and there is an urgent need for improvement in many aspects of housing.

Before 1949, most houses in Beijing were single-story traditional courtyard houses. In the last 40 years, large numbers of 5-to-7 story medium-rise and 8-to-20 story high-rise apartment houses were constructed throughout the inner city as well as in expanded urban areas. The density of this new development is high, averaging 500 to 800 occupants per hectare. Zoning regulations dictate that a typical residential area be structured into either a residential district (30,000 to 50,000 inhabitants), small district (7,000 to 15,000 inhabitants), or housing groups (1,000 to 3,000 inhabitants), each with a certain area of public space called a "green area".

[1] Living area: termed living floor area in China accounts for the total net floor area of living rooms and bedrooms in a dwelling unit.

Strongly influenced by ideas of the former USSR and "western modernization", the layout of residential areas in inner-city Beijing resemble the tower-in-a-park design, with slabs and point blocks arranged in intervals. In 1994, Professor Jun-hua Lu, a housing expert from Beijing's Tsinghua University, wrote that the spaces in newly built multi-story housing estates open in many directions, and thus seem to belong to "everyone but no one". Neighbors are relatively unfamiliar with each other and crime rates are higher than traditional neighborhood. It is very difficult in this situation to establish a sense of belonging or identity in the community (Lu, 1994, p.45). With identical, mass-produced buildings, many critical issues in the planning and design of outdoor space are ignored. The resulting open spaces are neither healthy nor safe for outdoor living, nor do they encourage social contact among neighbors.

So far, despite the growing need for improvement, this issue has not received adequate attention from either the government or architects. Although quantitative aspects such as density, unit size, building height, sunlight distance, and numerous design norms are regulated by planning codes, there are very few laws or codes governing qualitative aspects of a neighborhood. Most architects ignore the issue of quality in building, while concentrating on quantity. There is a lack of systematic study into the quality aspects of the design of public open spaces.

In recent years, some architects have started to address the issue of open spaces in their design practice. Juer Hutong urban renewal housing and Enjili community, both in Beijing, are among these pilot projects. The former is intended to integrate new development into the urban fabric of the old city and the latter tries to create an environment that will accommodate a new living style other than in the traditional neighborhood.

Mass housing with its urban planning approach continues to be a formal housing form in Beijing. Some serious issues in the organization of public open spaces will continue to exist. These issues, mostly associated with security, community facilities, and outdoor

social life, have received inadequate attention from architects and urban planners. A thorough study into the nature of public open space is essential. Bai, the designer of the Enjili project, also called for "a scientific study of all the issues in environmental design" (Bai, 1993, p.51).

The elements of public outdoor space can be classified into two categories. One is related to space in terms of spatial order, form and scale; the other relates to texture, surface treatment and furnishing. According to many researchers like Curran, Blumenfeld, Ashihara, Bai, and Gehl, public outdoor spaces should have a hierarchical order and a human scale; the surface treatment and furnishing should be properly applied to meet the function of the space. The contemporary study shows that the quality of the public outdoor space lies not only in physical aspects of environment but also in social and psychological aspects. In other words, the built environment should accommodate healthy and safe domestic living, as well as social activities. The more time people spend outdoors, the more frequently they encounter each other and the more they talk to one another. This connection is important to physical planning and design. Architects and planners can improve the quality of social life through designs which facilitate interaction among the residents while ensuring that fundamental services are maintained.

Green areas usually make up 10 to 15 percent of total land use in public housing in China. In planning formal housing, priority has been given to large green areas over smaller, more intimate outdoor spaces that could serve the needs of a few families at a time. In fact, completed formal housing developments in Beijing have demonstrated that large public spaces tend to be unused, and are very difficult to maintain (Bhatt, 1993, p.10). These green areas are not used as frequently as the spaces located between apartment buildings, Since spaces between buildings are located close to each home, they are the most convenient, and frequently used outdoor spaces. Moreover, they make up of more than 30 percent of the land use in residential areas, much larger as a whole than green areas. Therefore, it is the space between buildings which should be given priority in the issue of open spaces in residential areas.

Scope and Objectives of the Study

With the aim of shedding light on the critical issues of public open space in Beijing's new housing, this thesis will focus on the space between buildings, which, because it exist alongside every apartment building, has the largest area and the most frequent usage by residents. The research will deal with residential developments completed in the last two decades in Beijing. Although high-rise apartment buildings are widely built as new developments because they allow for high density living, medium-rises are more pervasive, especially in and around the old city. Therefore, spaces around mid-rises have more impact on the living environment of Beijing residents. While high-rises are worthy of a close study, mid-rise buildings will be the study scope of this thesis.

The objective is to answer following research question:

What is the idea quality of space between buildings, and to what extent is this quality achieved in Beijing's new housing?

Organization

This thesis is organized into five chapters:

Chapter 1 introduces different prototypes of residential planning in three historical periods of modern China and explores both the origin of each prototype and the social-economical reasons for their adoption. Emphasis is on the years after 1977, the period of greatest transformation in Chinese history. The aim is to outline the general context of residential area planning in socialist China.

Chapter 2 is an analysis of the demand for space between buildings. It gives the cultural, behavioral and social-economic background of contemporary Beijing.

Chapter 3 contains a detailed examination of the theoretical and practical issues, and the meaning and significance of space between buildings. It identifies the basic concept, components and qualities of space between buildings implied in housing planning and

design. The relevant literature on the topic is critically explored and several criteria are set for further study.

Chapter 4 studies six cases with different characteristics. These studies are based on the principles developed in the first three chapters.

Chapter 5 presents the major contribution of the thesis; it suggests both the policy and the practicing guidelines for designing space between buildings.

Chapter 1
Planning of Residential Areas in Beijing

1.1 A Brief Historical Review

Neighborhood Unit Pattern: 1949-1957

Soon after the communists took over the government in 1949, almost every major domain of national production was reorganized. The increase in government organization, institutions and enterprises resulted in a boom in urban areas (ECBCH, 1992, p.266). This caused a major urban housing problem. Eager to gain the people's trust by showing its concern and by demonstrating efficiency, the new government immediately launched a series of programs to reconstruct and reorganize the country (Broudehoux, 1994, p.27). In the area of housing, the government began to renovate many old houses, as well as build more new dwelling units.

Due to financial restraints, poor building technology and time limits imposed on projects, some of the single-story row houses were built in the suburban area of big cities. These houses all faced south, and were arranged in identical rows, mimicking the layout of "military camps" (ECBCH, 1992, p.266). Basic facilities and services such as toilet and water supply were not available.

Lacking experience in new building planning and design, the government sought to learn something from abroad (Bai, 1993, p.28). At that time, "Neighborhood Unit Planning Theory" was introduced to China. According to this theory, a "modern" residential area was comprised of many neighborhoods with five thousand residents in each (Zhu, 1996, p.7). High-speed traffic circulated outside the neighborhood intended to preserve the security and tranquillity of the residents. Inside each neighborhood, there was a neighborhood center, containing a primary school, recreation centers, and shopping centers. Houses were built around this neighborhood center. Buses stopped at every corner of these neighborhoods. Each neighborhood was approximately 40 hectares in area (ECBCH, 1992, p.267). Two examples of this theory are Fu-xing-men-wai in Beijing and Cao-yang-xin-cun in Shanghai.

In the Fu-xing-men-wai neighborhood, roads are circuitous, with two to three story garden houses, and there are some of the basic service facilities, such as primary schools and stores. Cao-yang-xin-cun neighborhood is a large-scale project, built on a site measuring approximately 160 hectares. Roads are designed following the topography. Green areas are arranged along the river. Public service facilities are allocated in a hierarchical order of residential area, neighborhood and lanes. Primary school students can walk to school without having to cross roads with heavy traffic.

By 1953, the production situation was favorable enough to be able to implement the First Five-Year Plan. China followed the example of the Soviet Union and learning from "big brother" became a national obsession (Bai, 1993, p.30). Furthermore, an imitation of the USSR brand of neighborhood was introduced into China, along with 156 imported industrial projects (Bai, 1993, p.30). This kind of layout evolved from the old street block and featured symmetrical layout along an axis.

A typical neighborhood was approximately two to three hectares in size, and surrounded by streets on four sides. Houses were arranged along the periphery of the site, creating an enclosure for a garden where a kindergarten and other daily services were situated. There were many diverse public outdoor spaces that were usually quiet and human in scale. The residential area of the Beijing Cotton Mill falls into this type of planning pattern. A "double periphery" layout was developed, based on the Soviet model, in an attempt to save land (ECBCH, 1992). Bai-wan-zhuang (figure 1.1) and San-li-he are examples of neighborhood planned in this way.

According to the Edit Committee of Beijing Construction History, this kind of layout has two major shortcomings. The first is that some corner houses were always in the shadow of adjacent buildings, which resulted in bad ventilation and inadequate sunlight. The second is that every neighborhood looked alike which made it difficult to locate homes due to the maze-like layout. This kind of periphery pattern was abandoned in the following years of residential area planning (ECBCH, 1992, P.270).

Small District Pattern: 1957-1977

In 1957, the "Small District" theory was introduced to China by Soviet experts. The basic rule of this planning theory was that an urban residential area should be composed of many Small Districts. Each district would cover 30 to 60 hectares and have 10,000 to 20,000 residents. Although the principle was similar to the Neighborhood Unit pattern,

these two methods had many differences in terms of density, allocation of public buildings and building heights. For the first time, regulations governing Small Districts were applied to the planning process. These rules cover land-use, density and public service facilities. Since that time, the Small District approach has been the basis for residential planning in China (Zhu, 1996).

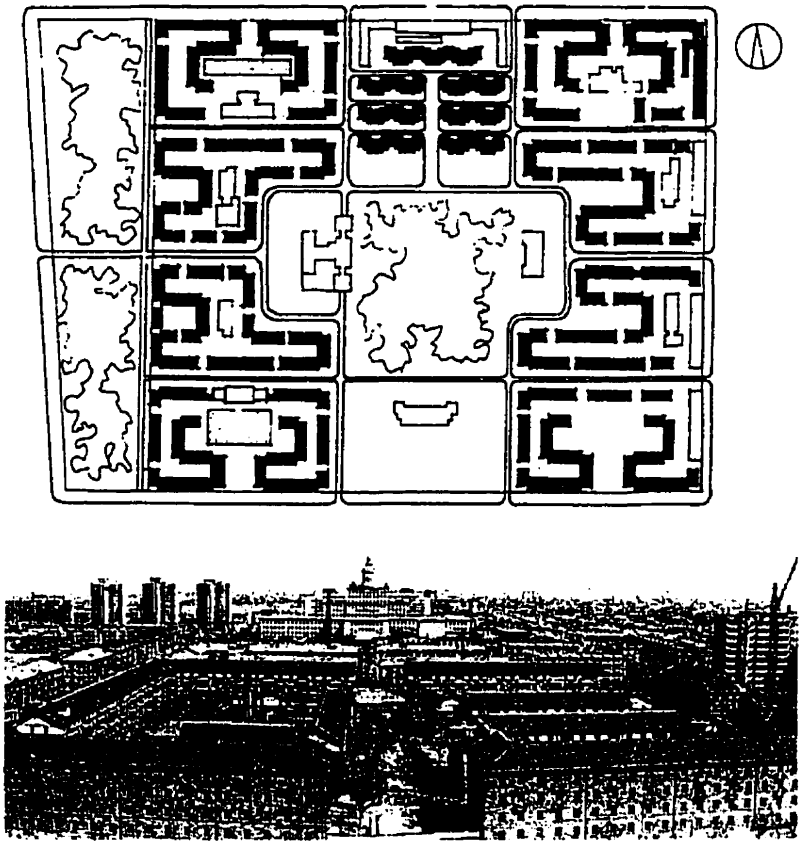


Figure 1.1 Plan and view of Bai-wan-zhuang residential area in Beijing (source: BMUCCDO, 1995, p.24)

According to Zhu, Small Districts have the following characteristics:

1) They are bounded by urban streets or natural boundaries created by trees, bushes or water. With clear borderlines, a Small District would never be divided by the main traffic of the city, and could thus be seen as a whole.

2) Their sizes are influenced by many factors including the traffic system in a city, topographical conditions, the height of houses, population density and, the extent and

function of service facilities. In general, the minimum population in a Small District depends on the smallest scale of a primary school. The maximum scope of a covered area is determined by the extent of service facilities. Depending on the needs of the residents, a Small District can be subdivided into several Housing Groups that usually include several rows of housing and a public open space.

3) They include a set of daily service facilities. Among these facilities are a primary school, a kindergarten, a grain shop, a grocery store, a department store, a vegetable and meat market, a farmer's market, and other general service centers. There should also be a secondary school if the district is oversized.

4) Circulation is organized in a systematic order, the roads of Small District level, housing group level, and entry roads to buildings are closed respectively, and decrease in width.

5) Public green areas are integrated with public centers, including children's playground and the outdoor exercise area for elderly people. (Zhu, 1996, p.8-9)

At the end of the 1950's numerous residential areas were built according to the Small District theory. He-Ping-Li of Beijing, built in 1959, and Fan-Gua-Long of Shanghai, built in 1963, are two typical projects. Figure 1.2 illustrates this design criterion.

According to Bai, the Small District theory was widely accepted and applied in China for the following reasons:

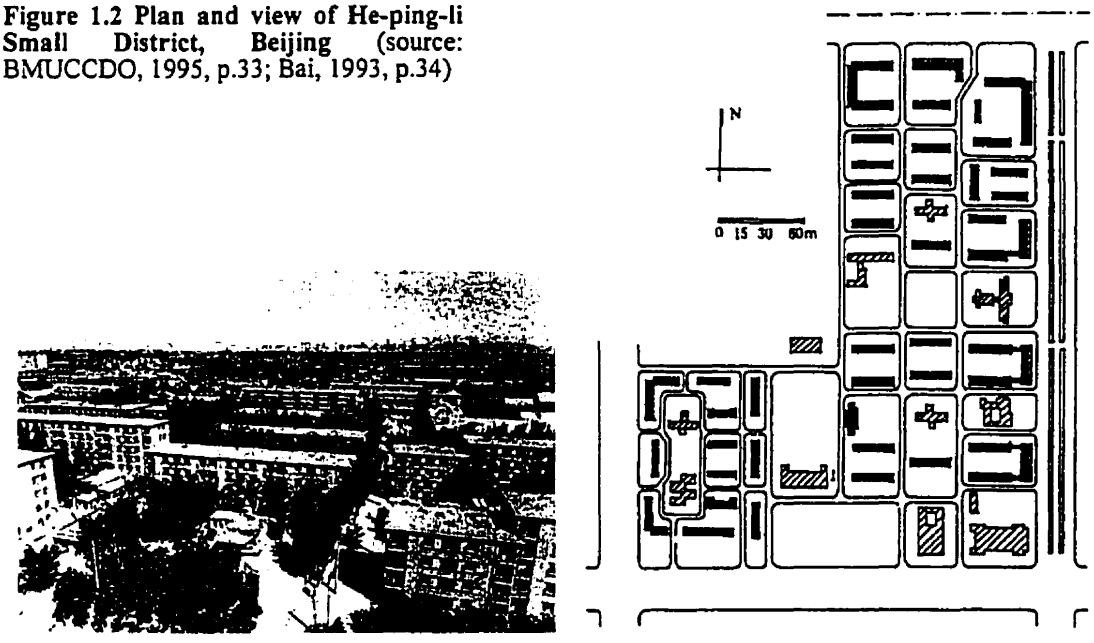
1) Social reasons: After the establishment of public ownership and social welfare, a collective living style was emphasized, making an open habituate typology which provided more services appropriate;

2) Economical reasons: Planned economy and unified construction made it possible to complete such a large-scale construction in one step;

3) Small Districts were more highly developed than Neighborhood Units, with regard to function and environment, and they provided a better planning alternative.

From 1966 to 1976, during the Cultural Revolution, a great deal of attention was paid to political ideology, while housing production and design were ignored alongside other production industries. Public construction was reduced to a minimum, and city planning offices were entirely shut down (Broudehoux, 1994). The housing construction budget was largely cut, resulting in the lowest housing standards ever seen in China (Zhu, 1996). Planning was simplified, apartments were built side by side in rows, and there were no more public open spaces in residential areas. This caused a dramatic reduction in comfort for the residents (Bai, 1993).

Figure 1.2 Plan and view of He-ping-li Small District, Beijing (source: BMUCCDO, 1995, p.33; Bai, 1993, p.34)



Residential District Pattern: 1977-present

When the Cultural Revolution came to an end in 1976, China moved in a new direction. The Open Door policy introduced China to the world, and to the international concepts at all levels (Kim, 1987). The new national goal of the four modernizations (industrial modernization, agricultural modernization, science and technology modernization, and national defense modernization) was repeatedly proclaimed (Murphey, 1980, p.145). The improvement of the living standards became the foremost concern of the Chinese government (Lian, 1995, p.14).

Severe housing shortage is a major problem in China's urban centers. This has resulted in overcrowding and inadequate living environments for the majority of urban residents. On one hand, from the early 1980's, the government increased the housing investment to 7

percent of GNP (Gross National Product), which greatly exceeded the average 1.5 percent of the past 30 years. On the other hand, a set of policies regarding housing reform were implemented throughout China which decreased housing subsidies and stimulated the construction industry (Fong, 1989). Ideologically, housing was no longer treated as a welfare service, but as a product for personal consumption, with household savings and enterprise investment playing a large part in housing finance.

In this context, residential area planning has undergone an essential evolution. By the "1982 General Plan of Beijing", it was felt that the previous "Small Districts" ideology failed to offer a sense of community to the residents, providing only the minimum of convenience of staple food and non-staple food stores. Very often, other facilities were not even provided since housing construction had been decentralized to local government units or even state enterprises for quite some time, and municipal governments had insufficient funds with which to supply the infrastructure and social facilities to accompany the housing. The grassroots political and administrative organization, the residents committee, serves 400-800 households, and the upper-level street committees are also not in congruence with the Small Districts in the territory. Thus the new plan introduced in 1982 requested a redefinition of the basic residential planning unit and enlarged it into the "Residential Districts" of 30,000 to 50,000 people with a total site of 60-100 hectares each. The planning of these new districts intended to take into consideration integration of basic community and urban facilities as well as the boundaries of the grassroots administrative organizations (Sit, 1995, p.205). Fang-zhuang is an example of Residential District planning (figure 1.3).

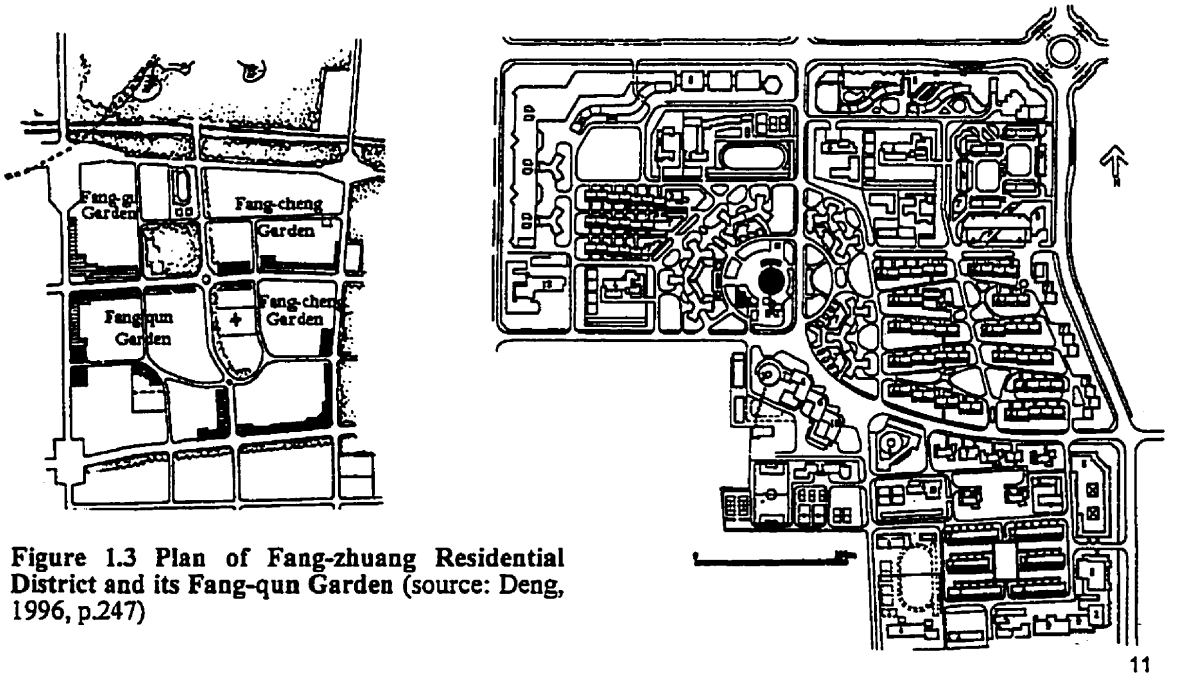


Figure 1.3 Plan of Fang-zhuang Residential District and its Fang-qun Garden (source: Deng, 1996, p.247)

The Standard Quotas per thousand residents (Qian-Ren-Zhi-Biao) for Residential Districts and Small Districts were updated three times in 1981, 1985 and 1995. Each time, the floor areas per thousand residents was increased 20 to 30 percent and many new items of public services were added (ECBCH, 1992, p.291; BURPC, 1995). Nonetheless, the large-scale and more efficient Residential Districts have far from solved the housing problems in China. Housing production and environment upgrading are still the major tasks necessary to improve living standards.

During the past 20 years, two important developments have affected the quality of the outdoor built environment in residential areas of Beijing: high-rise apartment buildings and "big-courtyard" pattern of space between buildings illustrated in figure 1.4 and 1.5.

In early 1978, thirty-one 9-to-12 story high-rise apartment buildings were built along Qian-San-Men Avenue, a important area in Beijing (ECBCH, 1992, p.339). From then on, particularly in the 80's, the floor area of high-rises in Residential Districts increased from 25 to 60 percent. In Fang-Zhuang (figure 1.3), an extremely large scale Residential District in terms of its site size and floor area, 89.2 percent floor areas are high-rises. The reason the high-rises were so popular was that the high-rise approach was considered land-use efficient, in other words it could enhance population density. Nevertheless, some architects argued about the cost-effectiveness and livability of the high-rises, saying that the high-rise was neither the best remedy for high density living, nor was it suitable for a historical city like Beijing (Wu, 1994, p.59). Furthermore, the outdoor environment in high-rise districts was not in human scale, making it difficult for the residents to live in and use them comfortably (Zhang, Kai-ji, 1990).

Figure 1.4 High-rises in Fang-zhuang Residential District (source: BMUCCDO, 1995, p.84)

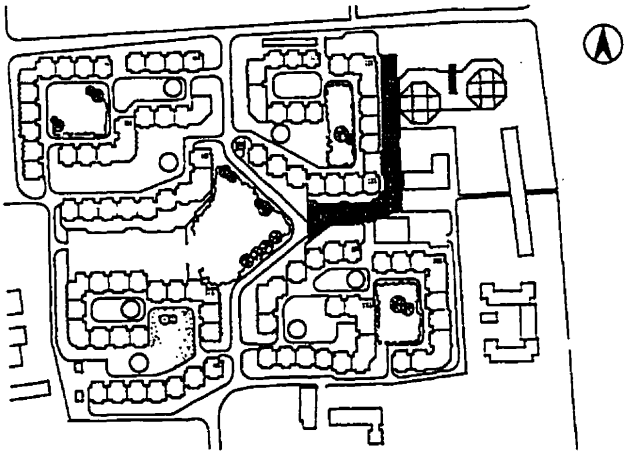


Figure 1.5 Big courtyard pattern of space between buildings in Kou-zhong-miao, Beijing (source: BURHO, p.10)

Prior to the 1980's, apartment houses in residential areas were arranged in identical rows. Although this pattern satisfied some basic requirements such as allowing sufficient sunlight and ventilation into rooms, it created outdoor spaces that were long and narrow, monotonous, and lacking in a sense of security (ECBCH, 1992, p.299). Since the middle of the 1980's, the big courtyard pattern has gradually taken the place of the row pattern. With one or a series of spaces enclosed by apartment buildings and walls, this new pattern creates a semi-private space, which provides the residents with a buffer from traffic, security, a sense of belonging and good opportunities for social contact (Bai, 1993, p.96). See figure 1.5.

1.2 The Current Residential Area Planning System in China

The Planning Mechanism

Although housing can be owned by the municipal government, by working unity and by individuals, all land in China is owned by the state. Buying land from the government gives developers the right to lease and use the land but not own it. The exchange of land between private individuals is forbidden.

Each parcel of land has a function that is defined by the government in the Master Plan of the city. Divisions are made by the main streets. A residential area could be a Small District or a Residential District, depending on the size of the site, and the density of the population. Inside a residential area, there is usually a loop of main roads that connect to city traffic in two or three places. The Housing Groups are arranged along the loop. Large areas of public open space, and some public facilities such as stores and kindergartens, are also near the main circulation of the district. There are no designated pedestrian streets. Inside a Housing Group, there is also a loop of road that is narrower than that of

the district where smaller-size publics open spaces and some basic public services are located.

Local governments are generally in charge of housing planning and construction. Design and planning institutions and construction companies monopolize most of the contracts for housing construction in each city (Broudehoux, 1994, p.38).

The Zoning Regulations

In China, zoning regulations vary from region to region. In Beijing, the main regulations for residential areas are related to amenities, density, building height, and sunlight. The most useful bylaw for a planner is "The Standard Quota of Area for Public Service Facilities in Residential Districts/Small Districts in Beijing", in short "Quota per Thousand People". It regulates the site area, floor area and other requirements per each thousand residents including all essential facilities, from public toilets or garbage disposal centers to kindergartens or restaurants.

Table 1.1 **Land-use Control in Residential Area**

Land-use	Residential District (%)	Small District (%)
1. Housing	45-60	55-65
2. Public Service	20-32	18-27
3. Roads	8-15	7-13
4. Parks	7.5-15	5-12
Residential Area	100	100

Source: Ministry of P.R.C., 1993, p.7.

Land use is normally regulated as follows: 50 to 60 percent for housing, 20 to 30 percent for public service buildings, 5 to 10 percent for roads, and 10 percent for parks (Table 1.1). Density of residential development is the ratio of occupancy (dwellings, persons, families or habitable rooms, etc.) to land area (hectare). It can be expressed in different ways, according to the choice of terms for occupancy of land area. In China, the most consistently used ratio is number of persons per hectare. The floor-area ratio, or FAR, regulates residential project density and serves as an important measurement of the optimum utilization of land (Broudhoux, 1994, p.40). Project size is generally expressed in gross hectares; areas devoted to community services and facilities, public open spaces, and major roads are included in the computation. But areas occupied by 'public' buildings, i.e., which do not serve the community, are excluded in the gross hectare. Since the 1980s, Beijing's overall plan stipulates that the maximum density in inner city

development is 600 residents per hectare; outside of the old city, this limit is extended to 800 (Bai 1995, p.236). The standard is regarded not only as a measure for saving urban land but also for maintaining good environments by the government. Small District and/or no high-rise follow the lower standard; and Residential District and/or high-rise areas follow the higher standard.

In Beijing's inner city, building height regulations vary from two to six stories according to their proximity to the historical area. Outside the second ring where the old city walls were standing, regulations are not strict and even high-rises can be built. According to the National Standard of P.R.C. (1986), medium-rise buildings have 4 to 6 stories and high-rises have 7 to 30 stories.

Building height affects density greatly. Although higher buildings require larger areas of land space between buildings according to the sun distance bylaw, generally, the more stories the higher the building density. For example, in the 1950s in Beijing, densities were around 400 persons per hectare when houses were then 3-4 stories. In 1960's, when houses were mainly 4-5 stories, densities were 500 persons per hectare. In the 1970's, when houses increased to 5-6 stories, densities reached to 600 persons per hectare (Bai, 1993, p.230).

In 1984, the Beijing Planning Bureau, China Medical University and the Beijing Epidemic Prevention Station began to study the levels of sunlight in housing in Beijing with the aim of establishing a standard. After researching the effect of sunlight on humans, measuring the presence of ultraviolet rays in the living room and studying the relationship between sunlight and rickets in children, they established the standard that every family must have access to at least two hours of sunlight a day. For the purpose of calculating the proper distance between buildings, the standard uses the sun's height on the coldest day of the year (January 20), which in Beijing yields a distance of 1.64 times the height of the building where the sun shines over it (Liu, 1995). The regulation after the 1980's states the standard distance of 1.7 (1.6 in inner city renewal projects) times the height of the building where the sun shines over it in Beijing. This is considered a healthy method to ensure maintenance of sufficient sunlight for residents. As a result, open spaces between buildings are approximately the same in width since buildings are almost all six-story high.

Chapter 2
Importance of Outdoor Space

2.1 Outdoor Living in Beijing

The well known Beijing writer Xinwu Liu, in the short story Bus Aria, describes a familiar experience for most people in Beijing who ride the bus:

> *Lifeblood of the metropolis.*
>
> *Anger. When you ride the bus, it's hard to avoid. Waiting, bored. Damn bus won't come. When it finally does come, it often zooms right by without stopping, with that little "Express" or "Special" sign in the window. Or, you run up to the door and it slams in your face with a bang. Even if you manage to squeeze your way on, the ticket-seller pushes and shoves you from behind, as if you were nothing but a sack of potatoes.* (Davis, 1995, p.349)

The separation of home and workplace becomes more common for working people in enterprises of all sizes in Beijing as in most of the cities in China. Commuters use bicycles, buses or the subway for transportation. As with other types of infrastructure in the city, transportation networks have become overloaded by the rapid population growth and demands generated by the booming economy. This overcrowding often results in unpleasant experiences when travelling in the city.

Compared to the chaos of the road traffic and the cramped quarters of the bus, open spaces within the crowded urban areas have been widely considered to be a valuable asset for the population. These spaces provide opportunities for many leisure, recreational, communal and social activities. As important urban amenities, they contribute to urban

residents' quality of life and to their overall sense of well-being. Indeed, some have considered public open spaces as an important requirement of a good and 'democratic' city form (Lynch, 1980). Urban parks provide natural surroundings, with trees and fresh air. Upon entering an urban park, one immediately senses the relative tranquil atmosphere and slow pace of activity. Grandparents stroll, sometimes while holding or pushing along children, lovers sit quietly in semi-seclusion on benches or rocks, old men with bird cages gather to chat, groups of people practice qi-gong or dance together (see figure 2.1). Since the parks act as a filter for noise, heat, fumes and smells, they are often described as the "lungs of the city"(Whitaker, 1971, p.10).

Like the city parks, public outdoor spaces in residential areas are arenas in which urban dwellers seek refuge and privacy (Davis, 1995, p.351). They are places where the value and scale of the individual can be respected (Whitaker, 1971, p.9). It has also been suggested by numerous researchers (for instance, Jacobs, 1961) that residential areas where there are many usable public outdoor spaces are well liked by their inhabitants.

Figure 2.1 View of a park in Hui-yuan residential district in Beijing (source: BMUCCDO, 1995, p.152)

Why do people need public outdoor space? Firstly, most people get a feeling of open countryside (Whitaker, 1971, p.4), and it is also a tradition for Chinese people to live close to the nature. In traditional Chinese paintings, "nature and human beings integrated

as one" has been a recurring theme. The most important principle of Chinese gardening is to learn from the nature. Even in Beijing's vernacular houses, courtyards are as critical as the main building, because they allow residents to remain in touch with the changing seasons. Secondly, people need to interact with others. Studies of pedestrian behaviour make it clear that people seek out groups whenever possible (Alexander, 1977, p.164). This is because human interaction is necessary for sustaining the human relationships that are the "bases for meeting human needs for affiliation and belonging" (Lang, 1987, p.163). Furthermore, these activities also "promote individual growth" (Lang, 1987, p.163), because they suggest new possibilities for behaviour- they are part of the process of socialisation.

Figure 2.2 View of the courtyard of a traditional Beijing Courtyard house (source: BMUCCDO, 1995, p.18)

People need have access to outdoor spaces in all seasons. In winter, the indoor air is full of cooking and stove-burning smoke, the odours of the residents, and the smell of household garbage. Going out for fresh air is essential. People have to adapt themselves to the contrast in the seasons, otherwise they will become unhealthy and less resistant to disease. On the other hand, adapting to seasonal changes promotes good health, and provides recreational opportunities. Outdoor activities include practising qi-gong, gong-

fu, disco, social dancing or singing Beijing opera. Even the snow provides them with new ways to entertain themselves and to exercise. There is even a song entitled "Outside world is wonderful", in which people in Beijing express their appreciation of the outdoors (Beijing Daily, Dec.5, 1997).

The weakest residents of the city—the children, the handicapped and the elderly also need access to outdoor spaces that suit their particular needs. Lennard (1987, p.145) asserted that many elderly people, especially women, live alone and in isolation, their families may not live in the immediate vicinity and they are no longer part of the work force. Furthermore, they do not regularly participate in social events, are less mobile, and would prefer not to be dependent on transportation to meet their daily needs, yet they need social contact and social activities, and to feel that they are a part of the community. Alexander (1977, p.217) argued that the elderly cannot be integrated socially as in traditional cultures unless they are first integrated physically—unless they share the same streets, shops, services, and common land with everyone else. A city that is hospitable to these groups will foster a sense of well-being among all its citizens (Lennard, 1987, p.145).

2.2 Great Changes Related to Housing in Recent Years

To achieve the "Relatively Comfortable Housing conditions"[1] by the year 2000, 1.6 billion square metres of new housing must be constructed in urban China, with a total investment of 495 billion Yuan (approximately 8.25 billion Canadian dollars), by the end of this decade (Chen, 1994, p.35). The Chinese government has acknowledged that housing can no longer be offered as a socialist welfare benefit because it represents an enormous financial burden. Housing construction had to be decentralised to local government working units, or even to state enterprises, however the municipal governments have insufficient funds with which to match the cost of such housing

[1] Relatively Comfortable Housing Conditions: A goal set by the minister of Construction as three indices. First, average living space per capita must be 8 square meters and more; Second, each household will have a decent housing unit; and third 80 per cent of these units will have a private kitchen and toilet. (Zhu, 1996, p.18-19)

construction with infrastructure and social facilities (Victor, 1995). In 1989, Beijing began to launch the housing reform program to commercialise and socialise the housing supply system step-by-step. The core of this reform was to transform the existing system of social welfare with a little commercialisation to achieve a more equal combination of commercialisation and social welfare (Chen, 1994, p.32). In the near future, all citizens will be provided with an equal chance to rent or buy a reasonably priced housing unit. There is no doubt that the quality of the outdoor living environment will be increasingly taken into consideration in the building of commercialised residential areas. The benefit of this approach will be felt by developers and residents. As sellers of commercialised housing, developers have to compete with each other to make higher profits. Improving the quality of the environment is one of the primary approaches for enhancing property values, and so, through their own initiative they can increase their profits. On the other hand, people are more likely to want to reside where there are pleasant surroundings to enhance their homes (Zhu, 1996, p.21). Moreover, laws and codes have been developed to regulate the building of a residential area. One example is the "Code of urban residential district planning & design", which has been in effect since early 1994, and which has become a national standard.

The enormous economic and political changes associated with China's reform program have brought about changes in the citizen's leisure time. The official work week in China was, from 1949-1975, eight hours a day, forty-eight hours a week. Since 1995, working hours have been reduced generally to forty hours a week, which has resulted in a significant increase in leisure time. A survey conducted by the Beijing Monitor Centre of Adults' Physique in 1998 shows that 49.45 percent of male adults and 44.28 percent of female adults exercise three times a week. Compared to the survey done in 1994, these numbers increased by 19.6 and 25.06 percentage respectively. The survey also indicates that, because of residents' low income, the major exercise locations are streets, roads, and free sports facilities.

The burden of housework has always been substantial, occupying a large portion of the non-working time of Chinese households. But due to the proliferation of various timesaving household appliances (refrigerators, washing machines, microwave ovens), the greater availability of commodities like food, the growth of the service sector, and most important, the increase in purchasing power of the average family, the time spent on housework drastically declined in the 80's and 90's. Thus the total amount of free time has increased. (Davis, 1995, p.156-158)

Table 2.1 **Leisure Time Per Day For Chinese People (in hours and minutes)**

	1980	1982	1984	1986	1988	1991
Free Time	2.21	3.26	3.16	3.59	4.31	4.48

Source: Davis, 1995, p.158.

Since many Chinese are still living in overcrowded apartments, the space between buildings is very important for leisure-time activities, especially for those who find their homes restrictive. Inevitably, with the increase of free time, the use of space between buildings is also increasing.

Since 1990, the private purchase of automobiles has increased far beyond what anyone could have imagined. According to the report of Auto World on the Internet (http://www.nease.net/n-space, August 11, 1997, in Chinese), in the year 1990, there were 4.6 million auto vehicles in China, of which only 14.8 percent were privately owned. In 1994, of 9.3 million autos, 2.05 million or 22.1% were private-owned. In 1995, 2.5 million vehicles, which comprised 23.8 percent of the overall 10.5 million automobiles in China, were privately owned. From 1996, momentum has been building even more rapidly than at any other time. In 1996, 13.19 million auto vehicles were sold in China. Of these, 11 million were purchased by private buyers. In Beijing, there were 110,000 more autos in the first half year of 1997, 86.6 percent of these were purchased by private owners. Reports from other sources have reached a similar conclusion: private ownership of cars is increasing (Table 2.2).

Paradoxically, there are no designated parking spaces in residential areas, resulting in the necessity for vehicles to park wherever they can. Although some architects anticipated this situation, regulations that guide the planning and design of residential areas still haven't been updated to accommodate this change. In practice, many newly built housing developments are without parking spaces, not to mention those built years ago.

Table 2.2 **Total Number of Cars Sold from January to December 1997**

	Total No. of Sold Cars	No. of Cars Bought by Private owners	Percentage of Private Buyers
Northern Auto Trade Market (in Beijing)	24,712	20,882	84.5%
Asian Games Village Auto Trade Market (in Beijing)	25,408	20,332	80.2%

Source: http://www.autofan.com.cn (January 27, 1998).

2.3 Types of Outdoor Activities in Beijing

According to many researchers such as Jian-da Zhu (1996, p.31-33), social, economic, physical, psychological, climatic, and cultural factors are most relevant to the behaviour patterns of residents. People of different ages, geographic locations and occupation have their own patterns of behaviour and needs for space, activities and amounts of leisure time. Nevertheless, people of similar ages and occupations show many similarities in their behaviour patterns.

Gehl (1987) put outdoor activities into three general categories, "necessary", "optional", and "social" activities. Zhu (1996) drew the same conclusion. He considered that "necessary", "spontaneous", and "social" activities were the major types of residents' living activities. Necessary activities refer to those that are more or less compulsory everyday tasks such as going to work or school, shopping, parking or picking up one's bicycle. It is their convenience and comfort rather than frequency that are influenced largely by the physical environment. Optional or spontaneous activities include those that are participated in if there is a wish to do so and if time and place make it possible, such

as going for a stroll, sun-bathing, or taking a break. These activities take place only when exterior conditions are inviting. Social activities include various kinds of communal activities indirectly supported whenever necessary and optional (spontaneous) activities can be carried out more successfully. Greeting, chatting and playing games are included in this category.

When outdoor areas are well maintained, necessary activities take place with approximately the same frequency. However, a wide range of optional (spontaneous) and social activities will occur more often and over a long period of time (Table 2.3). This connection is important in relation to physical planning and design. Architects and planners can enhance the quality of outdoor life by increasing the possibilities for optional (spontaneous) and social activities.

Table 2.3 **The relationship between the quality of outdoor spaces and rate of occurrence of outdoor activities**

	Poor quality of outdoor spaces	Good quality of outdoor spaces
Necessary activities		
Optional (spontaneous) activities		
Social activities		

Source: Gehl, 1987, p.13.

2.4 Behaviour Patterns of Different Age Groups in Beijing

Table 2.4 **Population Structure in Beijing**

	%
Kids (0-12 years old)	17.7
Teenagers (13-19 years old)	8.3
Adults (20-64 years old)	66.1
the Elderly (65 years old and older)	7.9

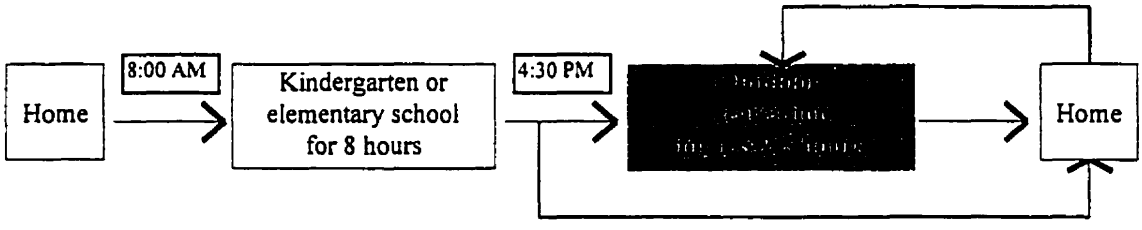
Source: Statistic Almanac of Beijing, 1993.

Residents are classified into four general categories by their ages in this study (table 2.4): children (0-12 yeas old), teen-agers (13-19 years old), adults (20-64 years old), and the elderly (65 years and older).

Children (under 12 years old)

Many parents consider that the healthiest way for children to learn is through outdoor activities. Children under 12 are extremely curious, active, and dependant on parents. They like to play with anything and anybody and are not likely to be aware of danger. Spaces with sunshine and small playgrounds close to home are the most suitable places for them.

Figure 2.3 **Life Cycle of Children in Weekdays (Exclude Infants)**



Source: Zhu, 1996, p.37-39

Table 2.5 **Important Locations for Outdoor Recreation of Children**
(numbers represent the approximate percentage of leisure time spent at the location)

Location	0-3 years old (%)	4-7 years old (%)	7-12 years old (%)
Space between buildings	75	44	12
Roads next to Home	16	19	24
Parks	--	29	48
Others	9	8	16

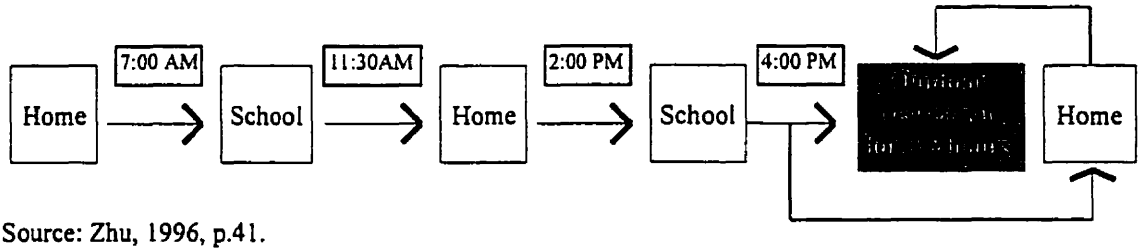
Source: Zhu, 1996, p.37-39.

Teenagers (13-19 years old)

Teenagers are in the stage of highest intellectual and physical development. They like to play sports, gather together in public, and seek out the limelight. Street corners, informal

gathering places, and lively community centre are the favourite places for their various outdoor activities.

Figure 2.4 **Life Cycle of Teenagers in Weekdays**



Source: Zhu, 1996, p.41.

Table 2.6 **Important Locations for Outdoor Recreation of Teenagers**
(numbers represent the approximate percentage of leisure time spent at the location)

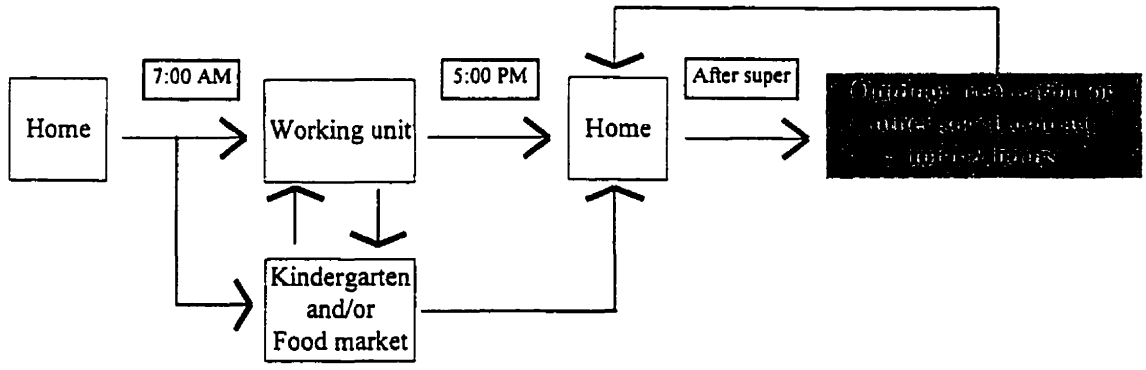
Location	%
Space between buildings	7
Roads next to Home	29
Parks and Community Centre	64

Source: Zhu, 1996, p.41.

Adults (20-64 years old)

Necessary activities such as doing chores and shopping are dominant in adult outdoor life. Most of the functional facilities in the neighbourhood are built for them. Usually there is only one bicycle shed in each space between buildings, and parking space is always not enough. When the shed is full, people seek to park their vehicles in the already cramped public lobby, or just leave them haphazardly in front of apartments, perhaps against a tree to avoid exposure to the rain. Since people prefer to have fresh food everyday, grocery shopping is a daily task for most adults. Early morning and late afternoon are the busiest times for this. The time spent on outdoor recreation varies among the different classes of workers. Generally speaking, blue-collar workers have more leisure time than white-collar workers because of less overtime working, therefore they tend to spend more time outdoors. Weather permitting, especially in summer, people like to take a walk and enjoy cool on the street or just sit on self-carried stools and chat in the open spaces or along roads.

Figure 2.5 **Life Cycle of Adults in Weekdays**



Source: Zhu, 1996, p.43-44.

The Elderly (65 years old and older)

Most elderly persons are retired and therefore have a great deal of leisure time. As family structure change (table 2.8 and table 2.9), the elderly lose their roles as parents, and need more social contact and care. Their favourite activity is to sit and chat with friends of the same age, followed by watching TV and listening to the radio (Lin, 1994). They form small, informal contact groups, consisting of several persons with similar feelings, behaviours, and lifestyles, to get together for common activities and face-to-face contact. Elderly women often chat, knit, and look after the grand-children at the entrance to the house, while old men gather away from the house, in streets and lanes or in parks.

Table 2.7 **Average family Size in Chinese Cities, Selected Years**

Year	1953	1964	1982	1990
Number of persons	4.66	4.11	3.95	3.00

Source: Lin, 1994, p.202.

Table 2.8 **Dwelling Patterns of the Elderly in Chinese Cities in 1988**

	%
Alone or with spouse	30
With young couple	59
Other	11

Source: Lin, 1994, 208.

Table 2.9 **Important Locations of Outdoor Recreation of the Elderly**

	%
Space between buildings	24
Park	17
Elderly centre (or tea house)	53
Others	6

Source: Zhu, 1996, p.49.

Summary

Early morning (7:00 to 8:00 am) and late afternoon (4:00 pm to evening) are the busiest hours for use of the space between buildings. In the mornings, most people leave their homes, while in the afternoon, people come back. Children and teenagers like to play, adults begin their relaxation after supper and the elderly stay outdoors for varying amounts of time. The space between buildings is favourable places for children and adults to relax, while teenagers and the elderly people tend to prefer parks and roads near homes. Generally speaking, spaces between buildings are more frequently used than any other public open spaces (like various parks) simply because they are the natural transition spaces in people's daily activities (Bai, 1993).

Chapter 3
Nature of Space Between Buildings

3.1 Definition

The term ***space between buildings*** used in this study refers to ***the outdoor space immediately in front of or between medium-rise houses***. It can be defined by both building edges and sidewalks next to roads. The words "garden just in front of housing" and "space around housing" are literally synonymous with the spaces between buildings, and they are used in many texts in Chinese to describe the similar area of space.

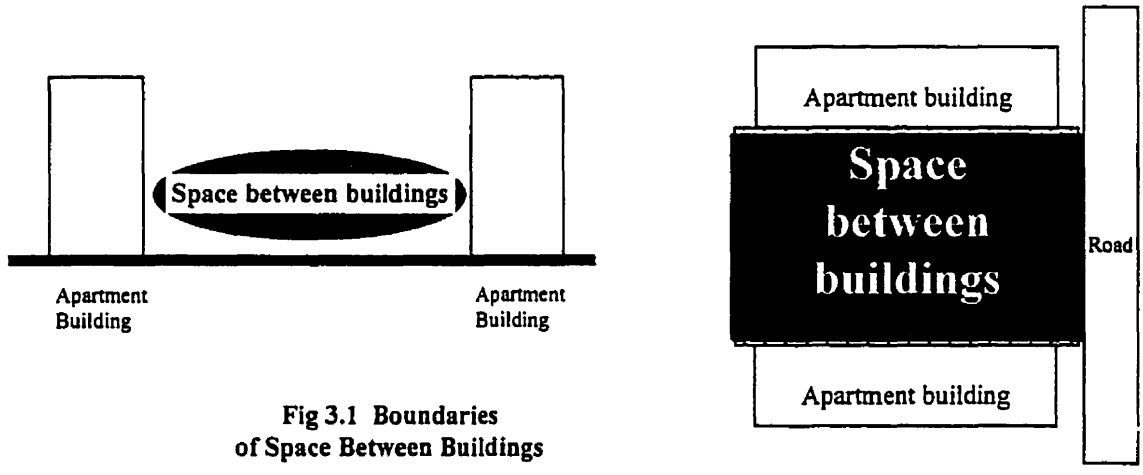


Fig 3.1 Boundaries of Space Between Buildings

There are several distinctions between the space between buildings and the various green spaces in residential areas. Spaces between buildings are naturally defined rather than delimited and segregated from houses, and therefore are more accessible than any kind of green spaces. They are more functional spaces while green spaces are dominated by greenery and playground. Individually, spaces between buildings are smaller in size than public green spaces. Nevertheless, since they are a part of the residential buildings

everywhere, they reflect the quality of the outdoor living environment more comprehensively than other kind of open spaces in a residential area.

3.2 Determinants of the Configuration of Space Between Buildings

Space between buildings is not just land left over around apartment buildings. In fact, its shape is the direct result of the regulations and practicing trends in residential project planning and design.

To achieve savings in capital and urban land, the Chinese housing authorities have adopted restrictive norms and standards regarding building density, building height, sunlight distance, and built-up area per household. In order to have more sunlight in main rooms, most of the apartment buildings in Beijing are south-north facing, not necessarily parallel to roads. Since the building height and density are conceived according to the upper limits requested by all the authorities and developers, the distance between buildings is inevitably kept as narrow as the regulation permits. According to sunlight distance, spaces between two five-to-six storied houses are approximately no more than 24 to 30 meters wide in almost all the projects. If four to five meters of private space of the first-floor occupants are deducted, public spaces are always 20 to 25 meters in width.

In addition to the regulation, the conventional design theory determines the physical shape of space between housing. As described in first chapter, Soviet influence on Chinese residential area planning remains strong, even up to the present day. The basic rules of urban pattern and building layout, which were brought into China by Soviet experts, did not change much over four decades. The socialist housing system and a symbolic sense of modernization could be the reasons for this unchanged situation. Planning of residential areas and the provision of urban housing were indeed part of the socialist control system for organizing the urban masses. Low-rent and equal-distribution policies were followed to ensure that urban housing was affordable to all. These policies required only quantitative aspects of the norms of housing rather qualitative, and it became necessary to explore alternatives. Other approaches such as low-rise, high

density, ground-related designs or mixed land-use design were discouraged. On a symbolic level, the new housing approach represented a break with the housing of the old days. The development of 'modern' cities and towns stood out as a 'symbol of progress' when compared with traditional courtyard housing which was overcrowded and poorly serviced (Bhatt, 1993, p.4). This notion has been popularly accepted, not only by the average person but also by professional planners.

3.3 Space Between Buildings as a Functional Component of a Neighborhood

Space between buildings is closely associated with the everyday life of residents. As the public open space in a neighborhood, space between buildings services many functions, so as to accommodate the outdoor activities of the residents. In accordance with the three types of outdoor activities, necessary, optional (spontaneous) and social, a well-designed space between buildings should have three functions: basic function, biological function, and social function.

Figure 3.2 View of a space between apartment buildings (source: BMUCCDO, 1995, p.141)

Basic function refers to the facilities for basic living use, which are related to necessary and optional activities. For example, access paths connect streets and buildings. People tend to conduct various kinds of housework in this road which is usually two meters wide, as well as bicycle repairs, car washing. Garbage chambers are next to each unit lobby. Bicycle parking sheds are usually located along access paths but there might be a big parking garage somewhere in the spaces between buildings in some neighborhoods.

Many people like to air their quilt or other big clothes in the spaces between buildings because they don't have enough space on their balconies.

Mumford (1960) indicated that the biological function of open space lies in the value of sunlight, fresh air, free movement in promoting health, and the psychological need for the sight and smell of grass, bushes, flowers, trees and open sky. Huang (1994) considered space between buildings as a critical element in improving the environment, and provision of fresh air and easy living condition because it has the capability of regulating the micro climate in terms of wind shelter, sunlight screen, dust and noise reduction, temperature and humidity regulation, bacteria control, etc.

Lennard (1987, p.63-68) explained that some of the functions served by social life in public were learning functions (learning through observation and participation), increasing social competence (practicing social interactive skills), informational functions (receipt and transmission of information), social awareness functions (sustaining the co-presence of persons of different backgrounds, experiences and perspectives), and more. The space between buildings has an impact on social functions. Alexander stated that the common land in a housing cluster had two specific social functions:

> *First, the (common) land makes it possible for people to feel comfortable outside their buildings and their private territory, and therefore allows them to feel connected to the larger social system—though not necessarily to any specific neighbor. And second, common land acts as a meeting place for people. (Alexander, 1977, p.337)*

3.4 Relative Importance of Space Between Buildings

Whether in residential districts or small districts, four types of land-uses (housing, public service buildings, roads, and public green spaces) are regulated by percentage in the "Code of urban residential district planning & design" (Ministry of Construction of P.R.C., 1994, p.7). Space between buildings is not a major factor in the planning process. There is not even an official term for that area. However, more and more researchers

believe that it is the space between buildings that should be taken into greatest consideration in residential area planning and design, because it is the most important outdoor space for residential areas in terms of its overall large percentage of land coverage and frequent use of residents.

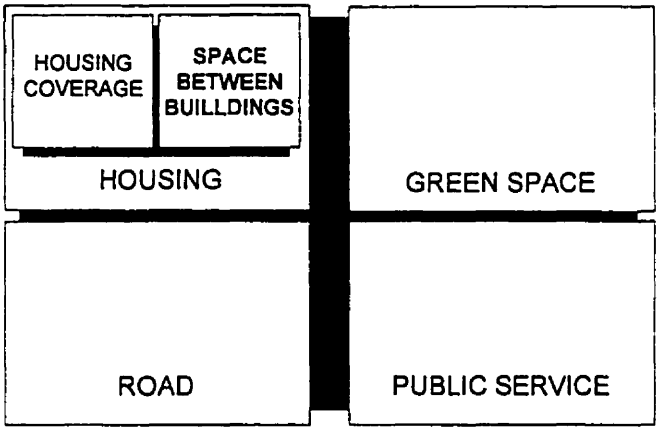


Figure 3.3 Residential Area Land-use

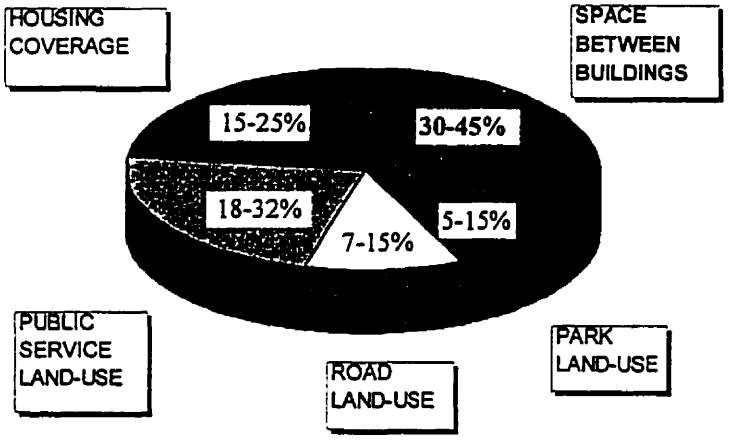


Figure 3.4
Approximate Distribution of Land-uses in Residential Areas (Both Residential District and Small District)

Source: Ministry of Construction of P.R.C., 1993, p.7; Calculation done by the writer.

Housing land-use, which includes not only the building coverage but also the spaces between buildings, comprises 45 to 60 percent the overall site area in a Residential District and 55 to 65 percent in a Small District (regulated in 'the code of urban residential district planning and design', 1993, p.7). Limited by the sunlight distance and

number of stories, the FAR of a residential area with mid-rise houses alone (5-6 stories) is usually around 1.1 in Beijing. Therefore, the coverage of buildings is around 18 percent (FAR/ housing stories). If we deduct the coverage of houses, the remainder of the land is the coverage of the space between buildings that comes up to around 27 to 47 percent of the whole site. From figure 3.3, it is obvious that the most quantitative component of the built environment of the residential area is the space between buildings.

A similar result can be obtained through another method of calculation. The maximum norm of "net housing density"[1] in a neighborhood with only mid-rises is 28 percent, which is regulated in "the code of urban residential district planning and design" (Ministry of Construction of P.R.C., 1993, p.12). That is to say, at least 70 percent of housing land is open spaces. Considering the percentage that housing land-use occupied in the overall site (45-65 percent), space between buildings are between 30 to 45 percent, much larger than the land use of public open spaces (5 to 15 percent of the overall site).

On the other hand, space between buildings also offers outdoor space for casual, daily use without the necessity for a planned trip to a park (Marcus and Francis, 1998, p.86). A survey conducted by Beijing Institute of Architectural Design in 1986 showed that most (up to 67 percent) of the residents' outdoor activities took place in the space between buildings (Bai, 1993, p.53-55). Alexander (1977, p.305) observed that even though people needed green open places to go to, if they are more than three minutes away, the distance was more overwhelming than the need. The only people who make full daily use of public green spaces are those who live close to them.

A study done by the Department of Planning in Baltimore, Maryland, indicates that neighborhood space is used for outdoor leisure time activities in two distinct patterns: in home-based areas (dispersed throughout the neighborhood) and in recreational facilities

[1] Net housing density: one of the control norms that limit the density of residential areas. It is the percentage ratio of housing coverage and housing land-use. (Ministry of Construction of P.R.C., 1993, p.5.)

(concentrated in areas such as playgrounds). Of these, the home-based spaces account for the major portion of recreational time. In addition, those spaces which can be used while retaining visual access to the home tend to be used more. The study also found that "most people will not regularly use a local open space if it is farther than 400 feet away from their homes" (Hester, 1975, p.32).

It is also argued that the larger pieces of public land which serve neighborhoods, the public green spaces and the community facilities, are fine for the neighborhood as a whole; but they do not provide a base for the functions that are common to a cluster of households (Alexander 1977, p.338). This suggests that as far as everyday heavy use by the residents is concerned, more emphasis should be put on designing spaces between buildings in the planning residential areas.

Figure 3.5 Residents practicing Tai-ji near homes in the morning (source: BMUCCDO, 1995, p.132)

3.5 Aspects of the Quality of Space: a Literature Review

The composition elements of space between buildings can be classified into two categories. One is related to space, which refers to the space order, form and scale; the other to the texture, surface treatment and furnishing. According to many researchers like Curran, Blumenfeld, Ashihara, Bai, Gehl, etc., space between buildings should have a hierarchical order and a human scale; the surface treatment and furnishing should be properly applied to meet the function of the space.

The contemporary study shows that the quality of the space between buildings lies not only in physical aspects of environment but also in the social and psychological aspects. That is, the built environment should be able to sustain a healthy and safe domestic lifestyle, as well as pleasant social activities. The more time people spend outdoors, the more frequently they meet and the more they talk to each other. This connection is important to physical planning and design. Architects and planners can improve the quality of residents' social lives by planning for the possibilities for meeting, seeing, and hearing people, while ensuring that fundamental services are provided.

There are two obvious interpretations of the concept of environmental quality, according to Rapoport (1977, p.61):

> *The simpler one is related to aspects such as air and water pollution, the consequences of overpopulation, depletion of resources, radiation, thermal pollution and the like. These we could call the material and biochemical aspects of the physical environment .... The more complex interpretation is related to the less easily definable, and more variable, qualities of the natural and man-made environment which give satisfaction to people, its sensory quality in all modalities; the positive and negative effects on human feelings, behavior or performance and its meaning. These could be called the psychological and socio-cultural aspects of the environment.*

In this study, eight factors are identified to determine the quality of space between buildings. They would cover both biochemical, and psychological / social aspects in order to make a comprehensive study on the livability of the physical environment. For the purpose of this thesis, the space between buildings is studied. The following is a literature review of the general requirements of these factors from a global perspective as well as in the context of Beijing.

Hierarchy of Open Space

According to Lozano (1990, p.85), "hierarchy is the basic structural order of complex systems with pervasive and universal laws of organization. Urban hierarchies are spatial systems with distinguishable levels. Each level is related to at least one other level." The hierarchy of spaces which constitutes the gradual transition from public through semi-private to private, and from communal into more private realms in a dwelling, is a function of design mechanisms, and is recognized as fundamental for achieving domestic privacy and territoriality of the neighborhood (Chermayeff and Alexander, 1966). The space between buildings can be seen as a transitional semi-public (semi-private) space between street and housing entrance. It offers residents a buffer zone not evident in housing which opens directly to the street (Alexander, 1977, p.549). According to Bai, it also increases safety to define outdoor spaces in a hierarchical order (Bai, 1994, p.99). The physical and symbolic facilities and spatial arrangement can provide an appropriate environment for regulating and managing the sense of belonging in the built environment (Rahbar, 1996, p.21).

In the traditional neighborhood of the old city of Beijing, courtyards, lanes, and streets are arranged in a hierarchical order. Lanes and courtyards are the buffer zones between the very public and the very private. Coming from the street to the home is a gradual transitional process, which gives visitors hints as to where the boundaries exist. On the other hand, going from home to the street is also a process that provides the residents with different levels of privacy. In Beijing's new residential buildings, the space between buildings, the housing group, the small district and the residential district are the different-sized outdoor spaces. A sequential arrangement of these outdoor spaces will provide the modern housing dwellers with the similar benefits, as they would find in a traditional living environment. If the buffer zone is missing it, for example, a busy street is located just in front of housing, residents will feel unsafe and uncomfortable to use the outdoor space.

Usable Space

Usable open space for active and passive recreation, for gardens and landscaped grounds, and many other outdoor activities, is needed in residential areas. However, not all spaces are usable, for example, leftover lands between buildings. There are two different kinds of outdoor space: negative space and positive space. Alexander (1977, p.519) specifies that positive spaces are well defined and partly enclosed; while negative spaces are poorly defined and the boundaries are ambiguous. Positive space is generally a result of human intention or planning; while negative space implies that the space is spontaneous and unplanned (Ashihara, 1970, p.21). People feel comfortable in and use spaces which are positive; people feel relatively uncomfortable in spaces which are negative, and such spaces tend to remain unused (Alexander, 1977, p.519). From this point of view, usable spaces are positive spaces and related to the quality of outdoor space.

Usable spaces should be designed so that they meet the requirements of most residents. Greenery provides people with fresh air and visual pleasure; paved areas allow children to play and adults to do some outdoor housework; bicycle sheds will shelter the bicycles from bad weather, etc. The higher percentage of usable space, the better the quality of the living environment (Bai, 1993p.94).

Since residents needs vary, the design of usable spaces should facilitate adaptability. As Lynch (1962, p.13) remarks, "most people need some 'give' or plasticity in their environment; they wish to mold it themselves to some extent, to enter into active relation with it". The designer will look into the future as far as he can, and any foreseen changes can be provided for.

Safety and Defense

Safety is also a key factor in people's choice of use of public spaces. It includes both physical and social dimensions. Physical safety includes facility considerations, such as the proper location of activity settings (like barriers and signs) intended to prevent the incidence of harmful accidents; social safety relates to crime (Hester, 1975, p.94).

Formal supervision by police or residents' committees helps to guarantee safety. However, in most cases, it is the natural surveillance of the residents themselves that is most effective against crime. When people begin to protect themselves as individuals and not as a community, the battle against crime is lost (Newman, 1972, p.3). Spaces under continuous natural surveillance are considered safe, and unused spaces are dangerous (Bai, 1993, p.92). Jane Jacobs (1961, p.35) indicated that there must be 'eyes' upon the public space to keep both residents and strangers secure; and these eyes should be sufficiently numerous to provide a deterrent. Large numbers of people should be attracted to entertain themselves continuously. Oscar Newman wrote in his book "Defensible Space", that architectural design can help create conditions for efficient surveillance indicating through the physical layout that an area is the shared extension of the private realms of a group of individuals. In other words, design can make it possible for both inhabitants and strangers to perceive that an area is under the undisputed influence of a particular group, that they dictate the activity taking place within it, and who its users are meant to be. Any intruder will be made to anticipate that his presence will be under question and open to challenge so that a criminal can be deterred from even contemplating entry.

Health and Comfort

Weather considerations such as solar angle, temperature, humidity, precipitation, and wind direction and force are important areas of study for the planning of a space because favorable weather conditions will increase the use of the space (Hester, 1975, p.102). Even though natural climates are erratic and violent, people defend themselves by physiological adaptations, and by the use of clothing and built structure (Lynch, 1962, p.88). In space between buildings, the control of microclimate and other man-made intrusions affect the healthy and comfortable outdoor living conditions of residents.

Beijing enjoys a typical warm temperature zone or continental climate. The four seasons vary greatly: spring (April-May) dry and windy; summer (June-August) warm and rainy; autumn (September-October) cool and moist; winter (November-March) cold and dry.

While sunshine is welcome at most times of the year, in the summer while shading is enjoyable to block direct sun radiation. Summer and fall breeze is favorable, while spring and winter wind from northwest which usually accompany with dirt and sand is annoying. Noise and airborne impurities are of man-made harms to the healthy and comfortable outdoor living. Traffic, commercial activities, and crowd of pupils are major source of noise. Exposed garbage and earth with dirt affect the quality of air especially in windy weather.

There may be surprising variations in the microclimate of a site due to vegetation and topography. Lynch noted that wind speed and temperature might vary markedly within a few feet of elevation:

> *The orientation and form of the topography, the type of surface materials, the plant cover and the location of structures, the presence or absence of water, all have striking impact on the micro-climate, on the quality of light, and the propagation of noise.(Lynch, 1962, p.20)*

Privacy and Territoriality

The concepts of privacy and territorial space are closely linked. Irwin Altman (1975) proposes a conceptual organizing model in which he considers personal space and territoriality to be major mechanisms for attaining privacy. Privacy can be broadly defined as the control of unwanted interaction (Rapoport, 1977, p.289) and it has to do with the ability of individuals or groups to control their visual, auditory, and olfactory interactions (Lang, 1987, p.145).

The type and degree of privacy desired depends on the established pattern of behavior, on the cultural contact, and on the personality and aspirations of the individuals involved. In general, overlooking, trespassing, and noise are considered nuisances and sources of encroachment on a person's privacy.

A territory is a delimited space that a person or a group uses and defends as an exclusive preserve; it involves psychological identification with a place, symbolized by attitudes of possessiveness and arrangements of objects in the area (Pastalan, 1970). Jon Lang (1987) indicates some basic characteristics of territories: 1) the ownership of or rights to a place, 2) the personalization or marking of an area, 3) the right to defend against intrusion, and 4) the serving of several functions ranging from the meeting of basic physiological needs to the satisfaction of cognitive and aesthetic needs.

Properly defined territory and exterior layout of space has a definite bearing on the level of outdoor privacy. The hierarchies of territories which include public, semi-public, semi-private, and private spaces seem particularly important in places where there is a great need for security. The use of walls, screens, symbolic and real territorial demarcations, and distance, are all mechanisms for attaining privacy which the environmental designer can control to some extent.

Social Contact

In the old city of Beijing, Hutongs, which are lane-ways, are mainly used by pedestrians and bicycles, as most are not suitable for motor vehicles. This kind of layout not only keeps noisy traffic away from the residential areas, but creates intimate and safe places in which people can conduct their social life. In the development of new housing, resident densities are higher and spaces between buildings are enlarged. As a result, the old living environment has been changed.

As the old Chinese saying goes, "neighbors are more helpful than distant relatives." Bai (1993) states that there should be social contact among neighbors for four reasons. First, people are likely to call on neighbors in times of need both for help with daily tasks and in emergencies. Second, good relationships among neighbors encourage people to communicate and share emotions so that they will receive sympathy and understanding. Third, social contact provides restrictions on people's behavior, forming social ethics. This will help to maintain standards of public hygiene, take care of grass, and discourage

spitting and making noises. Finally, recreation in leisure is absolutely necessary in social life. In general, good neighborhood relationships are essential for a peaceful and lively community.

The design of neighborhood space can foster social interaction in many ways. Community centers, for example, can be designed as social focal points; apartment buildings arranged to encourage social interfaces; paths, neighborhood stores, open spaces, and playgrounds designed to maximize informal interaction; and, housing planned to increase neighborliness by decreasing the functional distance between neighbors (Hester, 1975, p.62). A somewhat higher proportion of residents tend to maintain close contact with others in communities with a lower average density, internal path systems, and with a higher proportion of households served by cul-de-sac streets (Burby & Weiss, 1976, p.355). These are all factors that are important for community planners to take into consideration to promote closer social contacts among the residents. Variations in social interaction, often a result of class and life-cycle stages, appear to be among the most important interaction variables to be applied to the planning of neighborhood space (Hester, 1975, p.71).

Aesthetic Appeal and Human Scale

Aesthetic appeal is another quality that may invite people to use space between buildings. A setting will convey clarity or ambiguity, meaning or senselessness, stimulus or monotony, pleasure or disgust (Lynch, 1962, p.55). Different colors, style, and spatial shapes will result in different atmospheres that may affect the emotion and behavior, of residents in either positive or negative way (Bai, 1993, p.203).

There are three major aspects in the design of visual form for a residential area: space, housing, and landscaping elements. Spaces should be designed in human scale and in sequential order. Human scale is considered as a measure "related to the size of our body, the speed of our movement, and our ability to identify and talk with other human beings" (Blumenfeld, 1967). According to County Council of Essex (1973, p.69), public space in

an urban area "must be broken down into a series of visually separate spaces in order to relate to the scale of the human being". To be on a human scale, the size of the place will have to be such that it is neither too large, nor too small, relative to the size of man. If too large, there will be a loss of comfortable contact with the surroundings, and a tendency towards a feeling of agoraphobia. If too small, the reverse sensation, a feeling of oppression or claustrophobia will result. Spaces such as wide squares, or straight, long streets are unrelated to human scale and the speed of pedestrian movement.

According to Mao (1988, p.28), in a cluster of buildings, the area should consist of a series of contrasting spaces, proportional to the appropriate degree of spatial enclosure, which is determined by the D/H ratio (the distance between two buildings/ the height of buildings). Ashihara (1970, p.44) observed that, the D/H ratio of an open space should between 1 to 2, to keep the space between buildings balanced and provide a sense of proportion. When D/H is smaller than 1, the open space becomes a space where building interaction is too strong, causing a feeling of "oppression or claustrophobia". When D/H exceeds 2, the enclosing forces that create the sense of open space begin to diminish and become less operative, leading to a loss of comfortable contact with the surroundings, and a tendency towards a feeling of "agoraphobia".

In a linear space, Bai (1993, p.209) suggests that grouping buildings, inserting open spaces, and varying the numbers of stories of buildings helps break monotony. It is suggested in "A design guide for residential areas" that in practice, the harmonious relationship of height to width for static spaces is 1.4; and for dynamic spaces 1.1 will not appear too tight (County Council of Essex, 1973, p.65)

Housing style and form are also relative to aesthetic value. Numerous architectural theorists such as Robert Venturi, and behavioral scientists such as Rudolf Arnheim have pursued the principles of composition in their respective works[1]. Lang (1987, p.189)

[1] See R. Venturi, 1966 and R. Arnheim, 1977.

summarizes these principles by saying that good figures have the following characteristics: symmetry, order, unity, harmony, regularity, conciseness, and maximal simplicity.

Maintenance and Administration

The references to maintenance and administration in this study relate to the general upkeep of exterior site spaces and visual elements, such as plantations. Regular attentions and grooming are important to the function and appearance of a space between buildings in a housing development. Maintenance is a matter that affects not the administrators who visit the estate periodically, but all of the residents.

The amount of needed maintenance will vary depending on how frequently a given area is used and the types of hard material and plant adopted. Therefore, at the design stage, it is important to use proper approaches and materials that vary according to the proper level of annual maintenance. Low maintenance site development simply refers to the coordination of site layout, grading and materials which minimize the time and costs of maintenance without an unreasonable decrease of the site's purpose and appearance (CMHC, 1982, p.53). The primary low-maintenance technique is to treat areas that may be costly to maintain with more durable materials. This is extremely applicable to the design of space between buildings in Beijing because of the low budget and general inefficiency of the maintenance and administration in residential area.

A flexible approach in the design is recommended to meet residents' further and unpredictable needs. It is also found that the amenities on an estate are more likely to be used with care if they are valued by the residents (GBMOHALG, 1967, p.25).

There are presently three kinds of agencies in charge of maintenance and administration of housing developments in Beijing: the Bureau of Housing Management (a department within municipal government), sub-district offices, and real-estate developers (Bai, 1993, p.249). In every district of the city, the Bureau of Housing Management (Fang-guan

bureau) has its subordinate agencies which are responsible for the repair and maintenance of housing. This kind of agency also has the right to destroy those 'illegal' structures which are mostly built by residents. The garden bureau (Yuan-lin bureau) is responsible for the maintenance of plant and street furnishings. The Environmental Sanitation Bureau (Huan-wei bureau) is responsible for cleanliness of streets and outdoor places and collecting garbage. These bureaus are parallel and independent from each other, and defining responsibilities can be ambiguous or difficult. Apart from the city-owned housing, a large amount of public housing belongs to working units. This property is managed and maintained by the construction offices in every working unit. In the case of financial difficulties within a working unit, the proper renovation and consistent maintenance of the structures is barely possible, and the space between the buildings, which belongs to everybody, is easily neglected.

Street committees (Jie-dao committees) are the administrative agencies of the municipal government. Being grass roots political organizations, they are in charge of every detail regarding the residential areas. Their main responsibilities are the administration of registered permanent residences and transmission of public information distributed by the government. They rely heavily on the assistance of the neighborhood committees which are presenting almost every housing group. These neighborhood committees are often combined with milk stores and other small services or service centers. Sometimes they will call for volunteers to do some public outdoor cleaning, according to instruction from sub-district offices, but mostly their duty is the surveillance of the housing area and reporting suspicious activities to the police in time. Since most of their members are elderly women, people call them "Small-feet detectives".

In recent years, real-estate developers have begun to participate in the management of residential areas. Because the area was planned and built by developers, they are able to envision and anticipate future maintenance and administrative needs.

3.6 Landscape Elements of Space Between Buildings

Outdoor space is defined by enclosure-overhead, and underfoot-and it has specific characteristics of its own. These characteristics have fundamental implications for the art of open space planning. Landscape elements are details of residential area design, which aim to provide a better treatment of the enclosure of space around buildings so as to provide a more attractive and characteristic setting for the homes. To contribute to successful site development, these elements should be well arranged according to their functions and required levels of maintenance. Four categories of landscaping elements are reviewed as follows: paving materials, walls and fences, site furniture, and planting materials.

Paving Materials

Once hard landscape areas have been identified on the site layout plan, it is very important to select the right materials to satisfy the site design objectives. The following three criteria set by the Canadian Mortgage and Housing Corporation (CMHC, 1982, p.56), can be also employed in Beijing when choosing paving materials. The first requirement is durability. The main function of a paved surface is to provide a hard, durable, non-slip surface that will withstand pedestrian and vehicular traffic. Another criterion is the material's subsoil and drainage characteristics. Sometimes subsoil conditions suggest the use of an impervious surface with full drainage; sometimes the paving material should allow precipitation to penetrate to the soil. The third selection criteria are the procedures and cost of maintenance. The material should not demand too much maintenance for continued use and should allow procedures such as cleaning and repairs to be easily performed, while also being cost effective.

Pavement needs not be colorless and dreary. With different colors and textures of materials, original and interesting designs can be achieved, thus presenting a changing scene to the pedestrian. The monotony of a long straight pavement and a barren appearance should be avoided (GBMOHALG, 1967, P.6). Also, variations in paving materials, patterns, colors and textures help to distinguish areas used for different

functions and activities. A visual identification of property ownership, or merely symbolic ownership can be achieved by a change of paving materials, a change in level, a physical barrier, or a combination of these (CMHC, 1982, p.54).

Walls and Fences

Walls and fences provide enclosure, protect privacy, discourage trespassing, reduce wind and modify climate, control traffic, define property lines, identify and emphasize entrances, and create and define outdoor space. Sometimes they may be used to screen noise from nearby streets or public places. They need not be solid however, and the occasional glimpse of another world through the gaps will divert the passer-by. Metal fences and brick walls with or without cement finishing, are most often seen as enclosures of private gardens or spaces between buildings. Public green areas are often protected by using low metal fencing. Shrubs and small flowerbeds are also used to separate a communal space from a public roadway. Stones and rocks are often used to build retaining walls. The texture, color and style of walls and fences should harmonize with the building's facade, and the layout should integrate into the housing site (Bai, 1993, p.177).

Site Furniture

Site furniture can include just about any object or configuration of objects. Bai (1993, p.172) put them into two categories: the utilitarian and the ornamental. The first category includes benches, lighting, waste containers, telephone kiosks, signage, bulletin boards, ramps, and play structures. Pergolas, planters, sculptures, and pools fall to the ornamental category. Site furniture can vary significantly in style, size and cost, and offer designers more potential for providing decoration and comfort. With thoughtful and creative design, even purely utilitarian objects, such as lamps, may contribute meaningfully to the whole setting.

Plants

The planting of trees, shrubs, vines and grass, as part of a landscape design, serves a variety of functions. By giving shade and screen, trees can effectively reduce sunlight glare and winter wind. Shrubs and hedges can be used to create outdoor walls, rooms and other defined spaces or to form screens to protect privacy. Plants that line streets, sidewalks or lawns, are physical barriers which control pedestrian circulation. Plants of less than one meter will discourage most pedestrians from entering and indicate ownership by illustrating a break between private and communal space. Grass is the most pleasant of all surfacing materials in spaces between buildings, where it provides a welcome contrast to the hardness of pavements and buildings. Each plant must be well integrated with its surroundings. Well-chosen and well-placed plants complement the architecture's visual character. As a result, they relate both in size and scale to surrounding buildings, landforms and the existing vegetation (CMHC, 1982, P.87).

Plants need care and will not thrive unless systematically and appropriately maintained, especially in the dry climate of Beijing. An untended planting area represents a waste of the initial effort and expenditure; it is unsightly, and is more likely to be misused by tenants. In particular, grass, without a careful design and proper protection to keep people from treading a path through it, can quickly turn into a pathway of mud.

3.7 Culture-Related Issues of Space Between Buildings

Preservation of Old City Image

From more than 700 years ago to the beginning of this century, Beijing has been the national capital of the latest three dynasties of ancient China. Its urban planning and design has been the most substantial among traditional Chinese cities, and is world-recognized (Wu, 1994, p.6-7). The checkerboard pattern of streets and lanes is one of the most unique characteristics of the neighborhood layout in the old city. The streets are busy, noisy places where the handicraft industry and commercial spaces are located. The narrow hutongs (lanes) are open spaces between traditional courtyard houses. Moving from large streets to hutongs, through gates and courtyards before reaching home

represents a hierarchical sequence of spaces from the most public to the semi-public, the semi-private, and most the private (Lu, 1994).

During the development of the old city after 1949, traditional street patterns and vernacular courtyard houses have often been demolished and replaced by conventional apartment buildings. By redeveloping the city in this way, it was thought that many potential difficulties such as relocation of residents would be avoided. However, with more and more international-styled buildings being built closer and closer to the inner city, the image of the historical capital has gradually deteriorated (Dong, 1993, p.110). In addition, there could be real psychological damage for people who are removed from a familiar environment when the old neighborhoods are bulldozed (Huang, 1989, p.23). To preserve the old city image in its very essence, is to preserve the old community - its inhabitants and their living environments developed through the years, which is the living component of the local folk culture (Lian, 1995, p.84). For this reason, many architects, planners, and researchers in other fields, advocate that old neighborhoods, being the important heritage of Beijing, should be rehabilitated in a sustainable way (Wu, 1994, p.63).

Two Different Lifestyles

In inner Beijing, the gates to the courtyard houses are all open to the small lanes, hutongs, which usually have not much vehicular traffic. As the old courtyard houses have become crowded as a result of house extensions, most of the courtyards have lost their ability to accommodate any activities other than entering and leaving home. Correspondingly, activities in the hutong have increased, and have now become the essence of inner Beijing's distinctive street life.

Since neighborhoods are clearly defined, residents of the inner city have strong sense of belonging and security. This tends to support neighborhood interaction. A research team led by Professor Lu from Tsinghua University of Beijing did a survey of a small branch of hutong in Guan-yuan area on the site of their urban renewal project. They found that

whether on weekdays or weekends, in rain or sunshine, there was consistent activity in the hutong. At one end, there was a small plaza and on the other, a corner shop where more people gathered. Peddlers, repairmen, street barbers, trash collectors and junk dealers present along the entire length of the hutong. Housewives hang clothes out to dry, chat and watch children; primary school children play soccer and elderly men play Chinese chess there. The hutong is a rich and lively place in which to live, and the residents all know each other and identify strongly with their surroundings.

As one moves out of the hutong, the outdoor environment changes radically. On a master plan of a newly built residential area of Beijing, public outdoor space usually looks very attractive with trees, grass, and winding pedestrian streets. However, a close examination will reveal apparent problems. Yang Liu, a doctoral candidate in Tsinghua University, argued in 1995 that in many housing renewal projects, even though the green areas are well-designed and well-managed, there are few people conducting their outdoor activities there. They like to rest or chat beside the road or near the entrance to the housing area, where residents must pass through, rather than in the central green space. Chen conducted a series of on-the-spot surveys of public outdoor space in residential areas, and wrote an article in 1995 entitled " Behavior Psychology and the Layout of Green Plots". After he found that people would rather sit on the uncomfortable fence by the roadside than on the comfortable benches on the green areas, he asked, "why was the meticulously designed place less alluring to the dwellers than the one carelessly built?" Zhou, Vice Minister of Construction of China, wrote in 1994, that "many new (residential) districts still lack one thing or another after the project is completed. For example, roads are built without curbstones; pavement is not paved. There are neither road lamps, route signs, benches for pedestrians to take a rest, nor green land, public toilets, garbage cans, etc.. There are no special facilities for children, elderly people and the handicapped such as the non-barrier facility."

3.8 Summary

The discussion contained in the preceding pages is a theoretical investigation of the concept of space between buildings. The space between buildings is a particular space typology in Beijing's new housing. Its shape is defined by the apartment buildings around it. Its north-south distance is the result of sunlight distance regulation. It is found in this study that the space between buildings is the most important open space for residents in a residential area because it has the largest land coverage and most vicinity to the residents. The quality, landscape, and culture-related principles demonstrate how this space could be a comfortable, meaningful and inspiring environment. The following case studies will analyze what has occurred in new housing development of Beijing, and to what extent these principles is followed.

Chapter 4
Case Studies

Six cases are chosen for the case study in this chapter because they are considered representing the current situation of Beijing's new housing development by the author. Fu-qiang-xi-li and Xiao-hou-cang are very well known projects among architects in Beijing for their unconventional treatments of open spaces. En-ji-li is one of a few national award-winning projects, and Juer Hutong has even won "1992 World Habitat Awards" as well as other national awards. Ta-yuan is a winning design of a competition in 1980 and well reflects the idea of conventional design approach. Huai-bai-shu is a typical urban renew project in inner city of Beijing.

4.1 Case Study 1: *Fu-qiang-xi-li*

General Condition

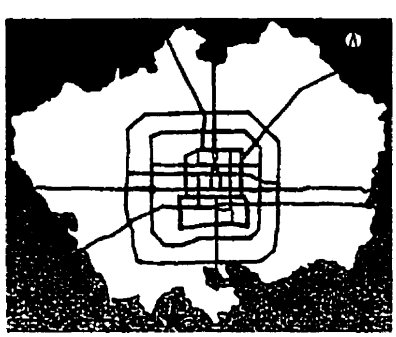


Figure 4.1.1 Location of the project

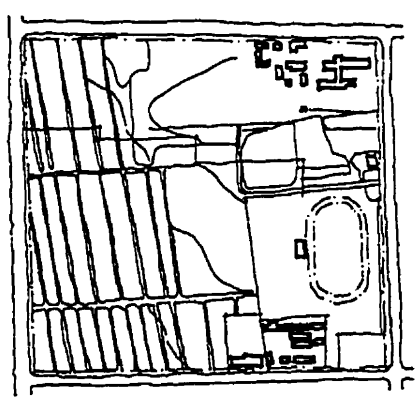


Figure 4.1.2 Existing condition
(source: Bai, 1991, p.41)

Fu-qiang-xi-li is located in the centre of Huang-cun, a satellite town in Da-xing County, south of Beijing outskirts. This small district accommodates seven thousand residents and occupies 12.1 hectares. On the west of the site are two pollution-free factories; On the

south is the residential area of the factories; the county stadium is in the east; and a park is situated to the north. The project was designed in 1983 by a group lead by De-mao Bai, an architect from the Beijing Institute of Architectural Design and Research. The development was launched in October 1984, and was completed in June 1988.

Planning and Design Features

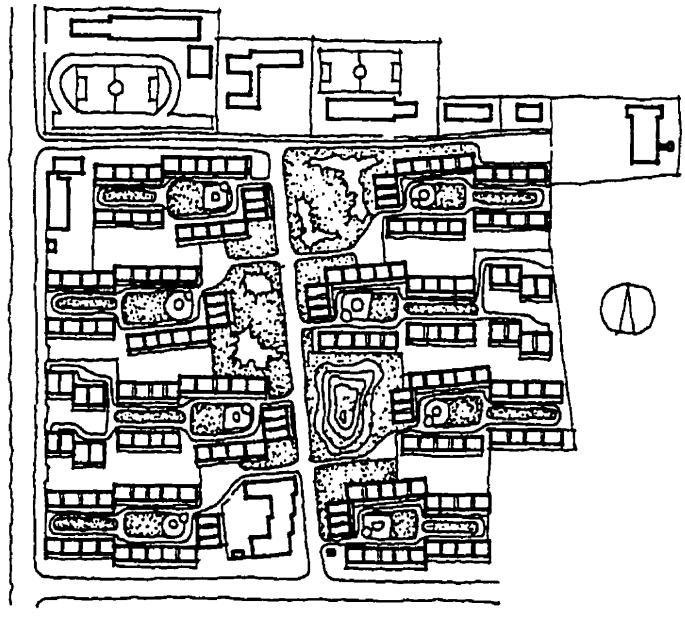


Figure 4.1.3 Site Plan of Fu-qiang-xi-li
(source: Bai, 1991, p.41)

The architect's initial idea was to pursue new ideas for housing layout, in particular to replace the parallel rows of houses which were dominant at that time. The existing site was a patch of flat farmland with some irrigation ditches that were not parallel to the street surrounding (figure 4.1.2). Bai's design (figure 4.1.3) used these ditches as basic guideline to define the main road. After its construction, some of the buildings next to main road are either perpendicular or parallel to the guideline. This makes the space between housing somehow dynamic and interesting. Each row of south-facing entry building combines with another row of north facing entry building forms a large ladder-shaped courtyard. The architect stated that putting the entries of both housing rows together, rather than keeping a single entry in one open space (Bai, 1993, p.77) would enhance the social contact between the residents. Housing groups interlock with each other so as to keep the minimum amount of land between buildings, while fulfilling the sunshine distance requirements. Along the main road, three small patches of green were

located between the gaps of housing groups. This arrangement of green space is distinct from the conventional approach of having one central green area. The linear green areas are closer to every housing group and therefore are more accessible for all the residents.

Observations and Analysis

Fu-qiang-xi-li has brought some fresh ideas to the design of residential areas in Beijing. One of them is that it separates territory of public and semi-public areas. The whole estate has only two entrances from outside, located at either end of the main road. Each of the entrances has a steel gate and a superintendent's office. Through the gate, people move from the city to the public domain which belongs to this community. The open space between buildings is defined as the semi-public space. It is a buffer zone between the community and private homes. This clear definition is achieved by enclosing every housing group into a cluster of buildings with an open space in between. Figure 4.1.4 and 4.1.5 show a housing group in plan and section.

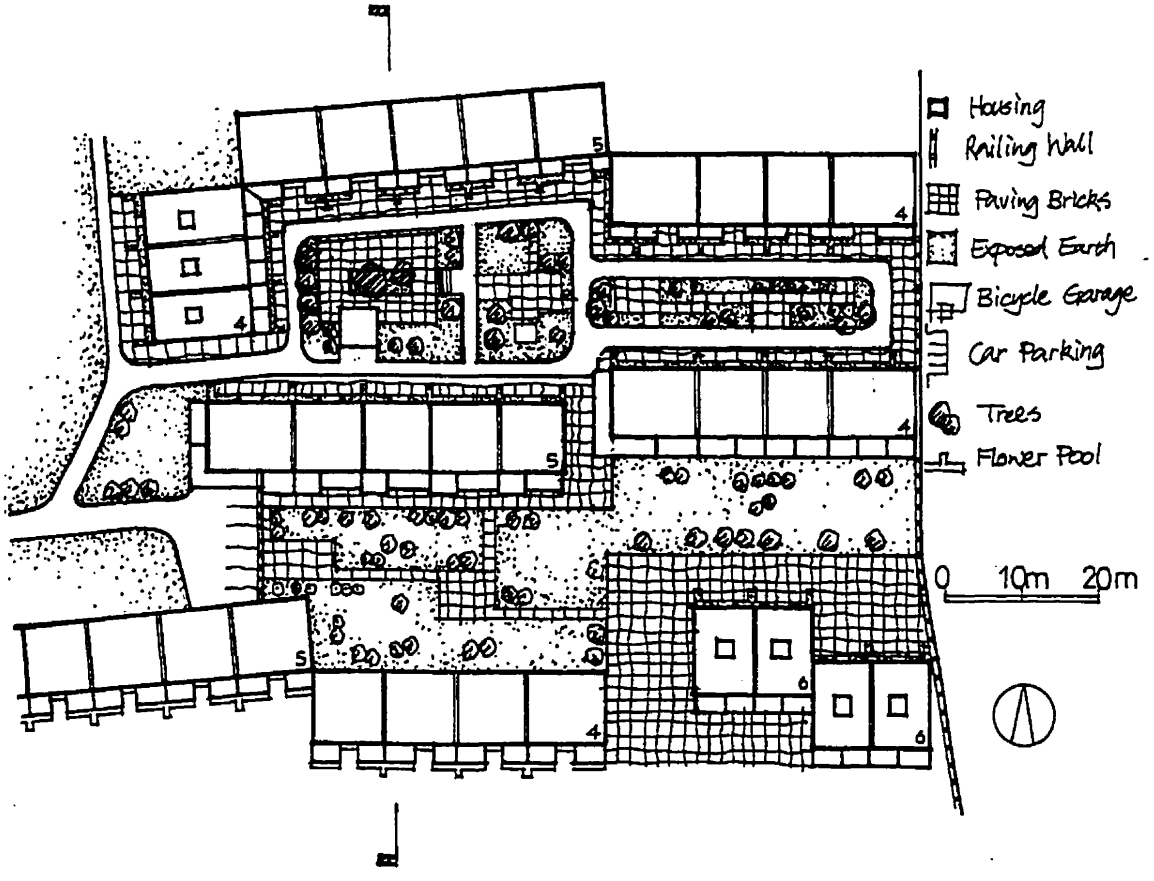


Figure 4.1.4 Space between buildings in Fu-qiang-xi-li
(source: Bai, 1991, p.42)

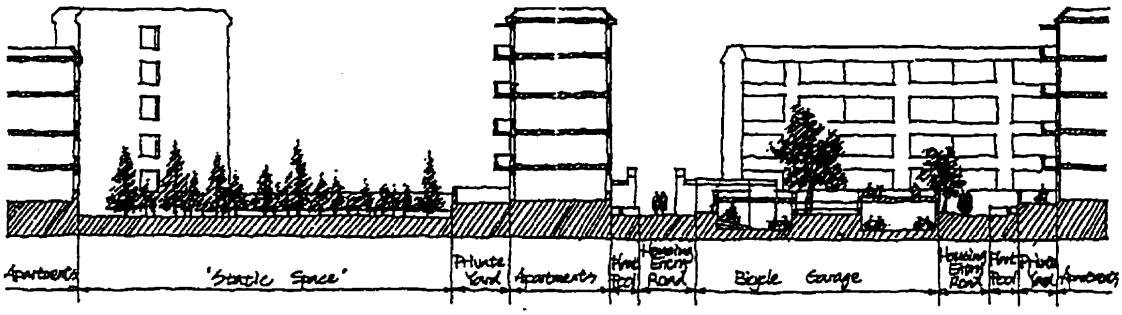


Figure 4.1.5 Section of the space between buildings
(source: Bai, 1991, p.44)

A typical housing group has four north-south facing and one east west facing apartment buildings, accommodating approximately 200 households. The semi-public space consists of a series of linear open spaces of slightly varying shapes and sizes. The area is well defined, giving a good sense of enclosure. However, this is not the case with every housing group. In a larger housing cluster, when there are more people sharing the open space, and when this open space looks long and vast, the sense of belonging is reduced. For the east-west facing residences to the east of the main road, entrances face the main road, not the public open spaces. This could affect their safety for the children, because of the narrow space between home and street traffic.

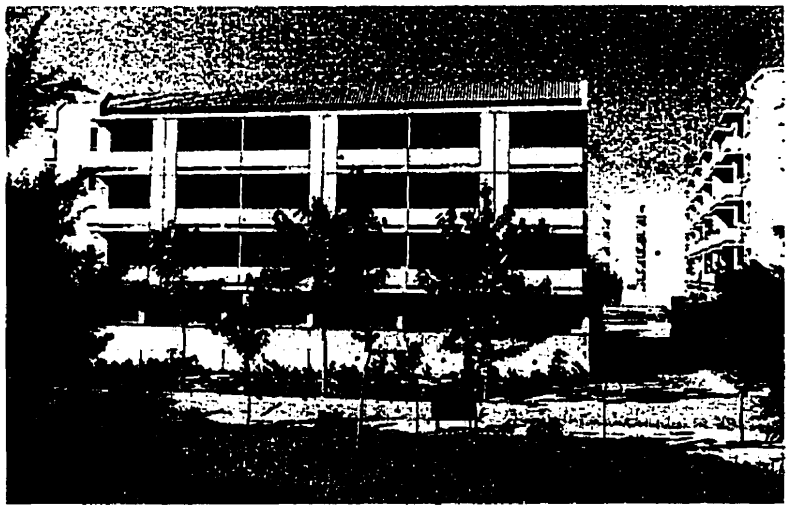


Figure 4.1.6 View from outside of a housing group
(source: BMUCCDO, 1995, P.67)

The single entrance also limits the potential for trespassing, and offers more self-surveillance possibilities. The architect (Bai, 1991) stated that since 1988, when it "opened", there has been very little theft. He attributes this to its design.

In the larger open space of every housing group, the distances between two housing rows are from 33 meters to 38 meters, or 2.3 to 2.6 times of the building height. This proportion gives the space a feeling of greater openness. In the smaller part, although the distance is 1.6 times of the building height, due to the low building height (four stories), the open space does not seem cramped.

Figure 4.1.7 View of interior of housing group

In the land between housing groups, there is no housing entry, and therefore it becomes a no-man's land in most of the residential areas. In the design of *Fu-qiang-xi-li*, some concerns were paid to this in its initial stages. The architect regarded this area as static space since the numbers of circulating pedestrians is fewer, compared to the dynamic space where there are entries. This space is intended to be used exclusively by people living in the housing group next door. A fence separates outsiders from entering and ensures the tranquillity of the area. However, due to the poor maintenance and lack of pedestrian traffic, this area is full of weeds and exposed dirt, and in fact, has becomes a wasteland (figure 4.1.8).

Figure 4.1.8 Land between housing groups

The most impressive structure situated in the public open space is the bicycle storage building (figure 4.1.7). This parking shed is virtually a single story building built with brick and cement. Although quite large in size, it does not block much of the view inside the open space, due to its semi-sunk design. By locating it near the entry of the housing group, the architect aims to use the tender of the parking shed as the guardian of the whole housing group. Being only one meter high, its roof can be used as a playground for children. Unfortunately, the big hole on the roof could be a possible danger for small children because there is no guardrail to protect children from falling off.

Figure 4.1.9 Bicycle storage

Fu-qiang-xi-li was the first residential area in Beijing to provide car parking lots in Beijing. Apart from a central parking area and one small parking area outside each housing group, cars are seen everywhere in the public space between buildings. As with bicycles, people prefer to park their cars as near to their home as possible so that they can keep watch over them, and have convenient access to them. If cars are allowed to come in to the housing group, a specific area inside for parking is needed; if not, a larger outside parking lot would meet people's needs. Alternately, another solution is to restrict cars. It is not clear whether Fu-qiang-xi-li's design allows cars to park inside or not, which therefore limits living space.

At the entrance to every apartment building, the pavement is different from the road, but still remains on the same level. This enlarged road enables multi-purpose use in this area. Beside the entrance, the planter may be used as a seat for parents to watch kids playing.

Private yards are enclosed with brick walls that are higher than eye level. This will ensure a high degree of privacy for the first-floor residents. In fact, many residents put a roof over the private gardens, which are easily changed to big rooms of around 15 square meters each. By using brick walls around private gardens, the design has had the unexpected advantage of allowing residents to adapt homes to their own uses. The design details are far from meticulous, but they consider the residents' activities more than other designs.

The building facade is finished in grey brick, a material widely used by local builders. The gable of the apartment building is similar to that of the peasants' houses. The architect here obviously attempted to add character to the buildings, even though the budget was small.

The pavements are all the same kind of cement paving blocks; simple but monotonous. What is intended as greenery in the public spaces between buildings is little more than yellow dirt, just like most of other developments. Apart from a lack of aesthetic appeal, the dirt and sand will inevitably be blown up by strong winds, to the point of obscuring the sky. Some residents store belongings outside, at random, also creating eyesores. An electricity box with a steel mesh fence is situated in every public space, and these are not well screened and become unpleasant to look at. After more than nine years of usage, the quality of the outdoor environment has become shabby due to poor maintenance and careless use. In addition to the neglected grass and other eyesores, some of the paving blocks are cracked, and roads are no longer flat.

Table 4.1 ***Fu-qiang-xi-li***

FU-QIANG-XI-LI			
Population density		563 people/ha.	
Building density (FAR)		1.076	
Year of completion		1988	
Land-use			
Site area		12.10 ha	100%
Housing land-use		7.6 ha	62.9%
Green area land-use		1.00 ha	8.3%
Road land-use		0.52 ha	4.3%
Public service land-use		2.97 ha	24.5%
Spatial hierarchy			
Public areas		Community green areas; main road	
Semi-public(semi-private) areas		Linear space between buildings	
Private outdoor areas		Private yards; balconies	
Space between buildings			
Type of space		Partially enclosed space	
Number of shared apartments		188-252	
Building height		Mostly 4-5 stories	
Configuration of space		**North-south distance**	19-38 m
		East-west distance	115-170 m
		D/H ratio	1.6-2.6
Usable space	**Semi-sunk garage**	Bicycle parking; relaxing and playing on the roof deck	
	Parking lot	Car parking outside housing group	
	Housing entry front	Sitting and watching children; social meeting	
Unusable space	Land between housing groups		
Landscaping elements	**Paving materials**	Concrete blocks	
	Walls and fences	Bricks; iron railings	
	Site furniture	Flower pools	
	Planting materials	Trees	
Maintenance level		Poor	

Source: BMUCCDO, 1995; Bai, 1991,1993; Visits to the project.

4.2 Case Study 2: *En-ji-li*

General Conditions

This award-winning project was designed by De-mao Bai and Mou-zhao Ye in 1988, and was one in the second batch of pilot projects of residential area planning and design in urban China[1]. It is located in the west suburban district, about ten kilometres away from downtown. On the east is a 60-meter wide city green belt and on the other three sides are the main streets of the city. As a small district, the development occupies around ten hectares and houses 6,546 people.

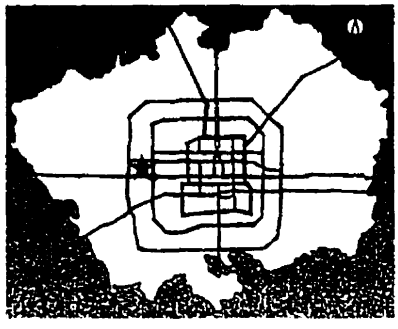


Figure 4.2.1 Location of the project

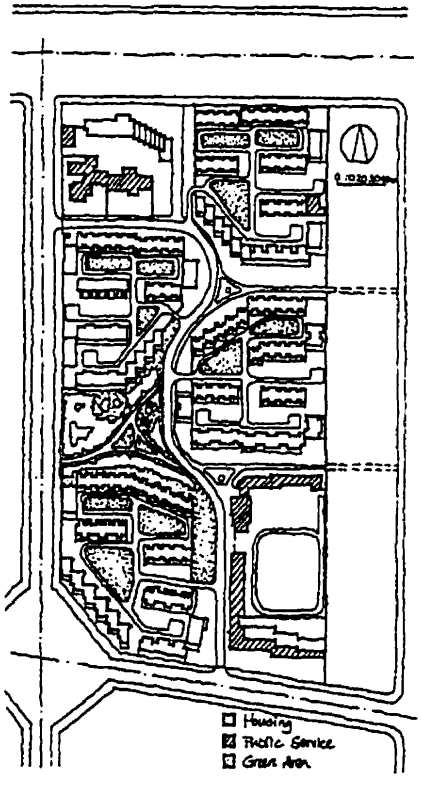


Figure 4.2.2 Plan of En-ji-li (source: Pilot Projects Office in Ministry of Construction of China, 1993, p.31)

Planning and Design Features

A curved main road is used by the architect to create dynamic scenes and at the same time, it slows down motor vehicles traveling within the community. Four similar housing

[1] The pilot project campaign is conducted by the Ministry of Construction and began in the late 1980's. The chief aims of the campaign are to improve the design and planning of residential areas by introducing and spreading advanced experiences and technologies.

groups are compactly arranged along the main road, and public services and open green areas are located between housing groups.

Each group of apartments accommodates about 400 households, with a neighborhood committee located near the only entrance of each group. Four rows of north-south oriented buildings and some east-west oriented buildings are combined together to make a cluster of open spaces in the housing group. These open spaces between buildings are enclosed by walls or metal railings, with all the housing entries facing inward. The buildings are slope-roofed, with one story lower on the north side than on south side. This treatment allows less sunlight distance between buildings while economizing on land, and gives buildings more character than the usual flat-roofed buildings. For the first time in a residential area, some basic barrier-free facilities were introduced in the buildings intended for public services. Schools, stores, and community centers have ramps to allow the disabled or the elderly to gain access to the first floor from the exterior.

Figure 4.2.3 View of the interior of a housing group
(source: BMUCCDO, 1995, p.98)

Observations and Analysis

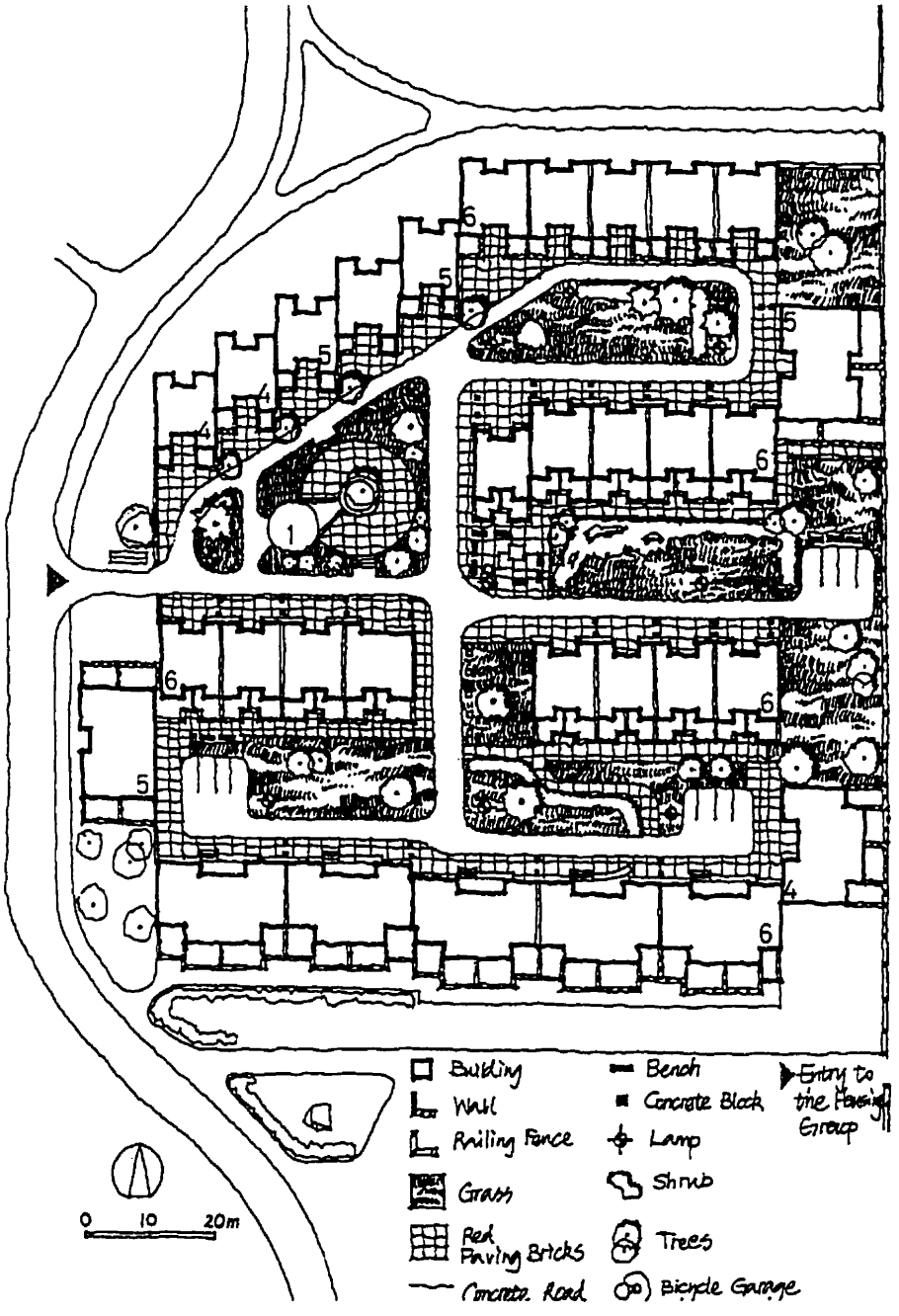


Figure 4.2.4 Space between buildings in En-ji-li (source: Pilot Projects Office in Ministry of Construction of China, 1993, p.31)

Apart from having a similar spatial hierarchy as *Fu-qiang-xi-li*, this project shows more consideration for the organization of open spaces. Along the winding main road, a series of views are constantly switched between soft-edged open green areas and hard-edged building gables. At the every corner of road, an ornamental stone serves as a vista for people coming from both directions. A gazebo in the central green area is the focal point

of the whole development. Inside housing groups, open spaces vary in sizes and shapes because of the step-like buildings and the spaces in contrasting scales.

Some spaces with specific uses, such as vehicle storage and outdoor resting-places, are well defined for the use of residents. Bicycle storage sheds (figure 4.2.5 and figure 4.2.6) are placed in two of housing groups. Like the one in *Fu-qiang-xi-li*, they are semi-sunken, one-story buildings. Several improvements have been made in *En-ji-li*: the roof is not as high as that in Fu-qiang-xi-li, and railings were added around the hole in the terrace to protect children from falling off. Most of the two and half meter wid· ıall roads in the housing group are cul-de-sacs, with small parking lots at the end. The parking lot is a practical addition and has four or five parking spaces designated to specific vehicles. Places to sit are everywhere in the housing group. Flowerpot rims, at every house entrance, are comfortable enough to sit on. There are two benches in each of open green areas, and at some corner places or beside green areas, benches are arranged in groups. For residents, it is easy to find a place to sit and chat with neighbors.

Figure 4.2.5 Bicycle storage at entry of a housing group

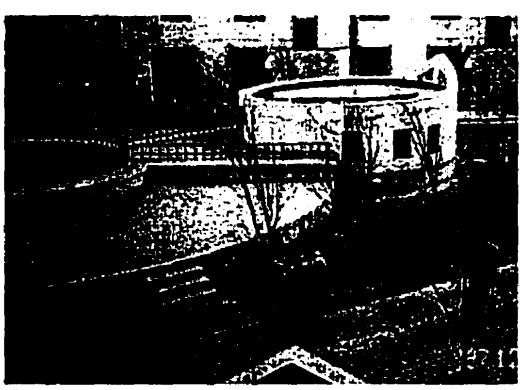


Figure 4.2.6 Terrace on the roof of bicycle storage

Figure 4.2.7 Small gathering place

Figure 4.2.8 View of a space between buildings

The landscape design of the project has many positive aspects. Good quality paving materials were used on a large area just in front of apartments. This is the most frequently used space. These paving bricks are relatively rough and intimate in scale, which makes them useful for many kinds of recreational or domestic activities, both for adults and children. Pavement near housing entrance is made from red paving bricks. It gives residents a feeling of arriving home and outsiders a warning that they are on the threshold of more private places. Hedges and shrubs are neatly trimmed, and various species of trees are planted regularly. The green areas are all covered with grass and exposed dirt is rarely found.

On the negative side, the problem lies in the inadequate subdivision of the space. Each housing group comprises more than 400 households, around 1500 residents. With such a large number of people, natural surveillance and self-protection from crime becomes less plausible. Meanwhile, many important facilities are not available to the residents. For instance, there is no playground, nor is there a special place for drying or airing clothes in the open sir. The design could have provided more usable spaces, or designated the area as wide-open space, where not much livable pedestrian activity would be expected to happen. This, however,would not achieve the goal of boosting social contact, and in addition, it would be less convenient for the residents.

Figure 4.2.9 View of a space between buildings

Table 4.2 ***En-ji-li***

EN-JI-LI			
Population density		655 people/ha.	
Building density (FAR)		1.202	
Year of design		1988	
Land-use			
Site area		9.98 ha	100%
Housing land-use		6.80 ha	68.2%
Green area land-use		0.85 ha	8.5%
Road land-use		0.37 ha	3.7%
Public service land-use		1.95 ha	19.6%
Spatial hierarchy			
Public areas		Community green areas; main road	
Semi-public(semi-private) areas		Cluster of spaces between buildings	
Private outdoor areas		Private yards; balconies	
Space between buildings			
Type of space		Partially enclosed space	
Number of shared apartments		108-252	
Building height		Mostly 4-6 stories	
Configuration of space		**North-south distance**	29-60 m
		East-west distance	40-100 m
		D/H ratio	1.6-1.7
Usable space	**Semi-sunk garage**	Bicycle parking; relaxing and playing on the roof deck	
	Parking lot	Car parking inside housing group	
	Sitting area	Sitting and watching children; social meeting	
Unusable space	Not found		
Landscaping elements	**Paving materials**	Concrete blocks; red paving bricks; concrete	
	Walls and fences	Iron railings with concrete base	
	Site furniture	Flower pools; benches; lamps;	
	Planting materials	Trees; shrubs; grass	
Maintenance level		Good	

Source: Pilot Projects Office in Ministry of Construction of China, 1993; Bai, 1991,1993;Ye, 1991; Visits to the project.

4.3 Case Study 3: *Xiao-hou-cang*

General Conditions

Xiao-hou-cang is located in the north-west corner of the inner city, in the West City district. The original site was occupied by single-story Courtyard Houses, most of which were badly maintained and in a dilapidated condition (Huang, 1991). Except for a primary school on the north-west and a kindergarten on the east, it is entirely surrounded by old Courtyard Housing. The new project was designed in 1987 by Hui Huang, an architect at the Beijing Institute of Architectural Design and Research, and built between 1988 and 1990. It was one of the three pilot projects for the urban renewal program conducted by the municipality in late 1980's.

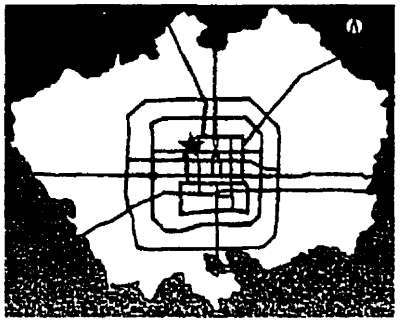


Figure 4.3.1 Location of the project

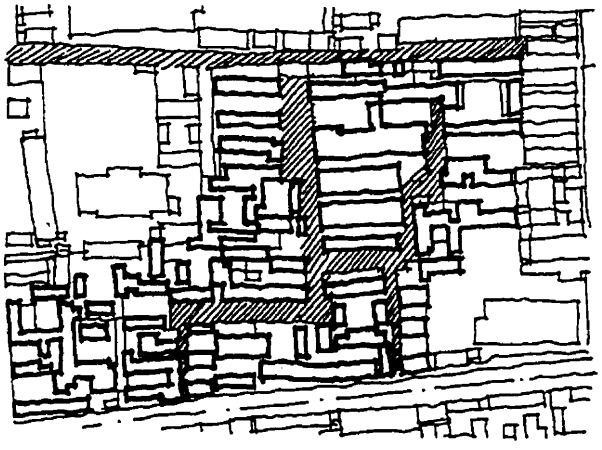


Figure 4.3.2 Existing condition
(source: Huang, 1991, p.47)

Planning and Design Features

Apart from raising sufficient funds for the construction, the main goals of the project were to keep all the pre-occupants on the site, and to improve their living conditions. According to the architect's report, the planning and design work was carried out under the following principles with regard to outdoor environment: to create a good living environment and provide space for both public and private activities; to maintain the traditional style and characteristics of housing in Beijing.

The site layout was inspired by traditional courtyard and lane (hutong) patterns. The concept of the lanes was reproduced by keeping the original location of lanes, and building new courtyard walls along the street. The houses are arranged into nine plots along lanes. Following the height limit regulation, buildings are two to six stories high, and are all walk-up apartments with south-facing rooms. The buildings have gray curved roofs, red railings and window frames, imitating the images of old Beijing Courtyard Houses.

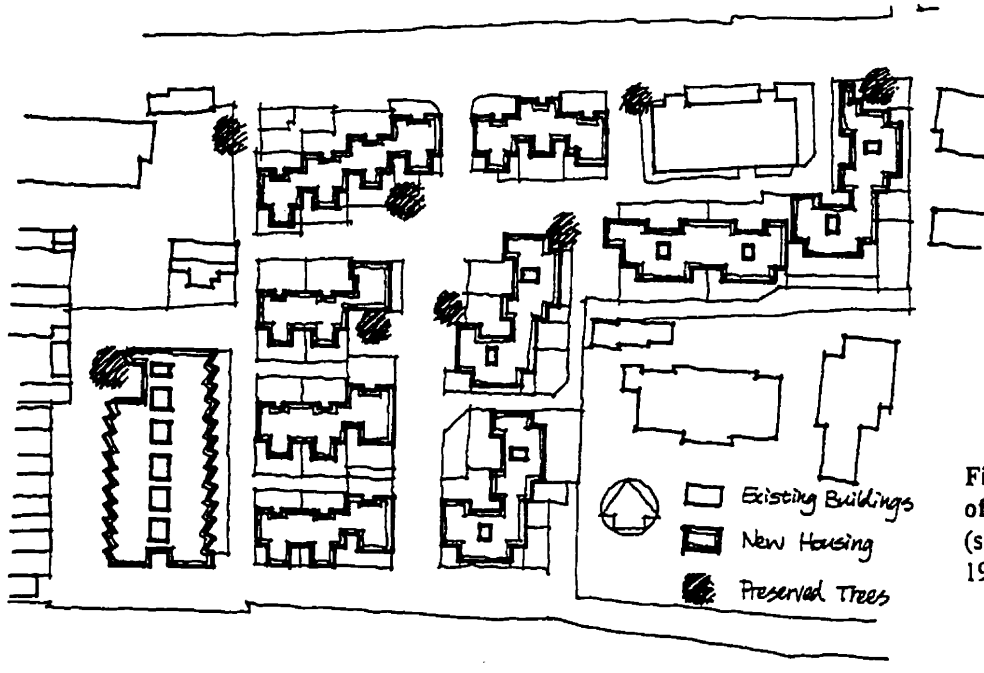


Figure 4.3.3 Plan of Xiao-hou-cang (source: Huang, 1991, p.50)

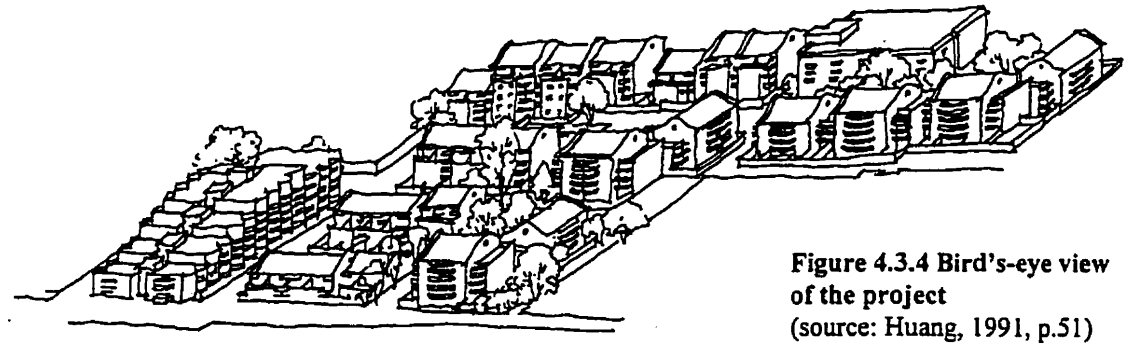


Figure 4.3.4 Bird's-eye view of the project (source: Huang, 1991, p.51)

Since the public green area is not large, the design sought to preserve existing trees as much as possible. These trees had an impact on the housing layout. It is the preservation

of the original lanes and trees that makes the outdoor spaces in rich diversity. Plots are enclosed by walls. There are 75 private yards belonging to the first floor homes, 12 public yards used by less than ten households, and eight public yards used by more than ten households. In addition, there are as many as 53 roof terraces for higher level homes which are used as private outdoor spaces. The streets are narrow, ranging from six to nine meters in width. Enclosing the street are gray brick walls and old style arched gateways here and there.

Observations and Analysis

From a design point of view, this project has many positive aspects. In fact, it is considered very successful in terms of improving the quality of the living environment of the original occupants. The social and physical structure of the existing neighborhood has been well preserved, offering an authentic taste of old Beijing. The residents are the same as before; the style, color and material of new buildings are similar to the old ones; the lanes and even trees are in the same location. All these efforts contribute to integrating the project into the old urban fabric, helping to maintain a traditional way of life.

Figure 4.3.5 View of a Small lane

At present, a traditional courtyard house has to accommodate several households in the inner city. This kind of housing is called a 'big mixed courtyard' which usually has problems related to inadequate privacy and unpleasant quarrels between neighbors

resulting from the conflicts which arise when using common facilities. On the other hand, when people, especially children and the elderly, move to apartment houses, they often experience feelings of loneliness, and miss the social life in old neighborhood (Huang, 1989). In order to maintain close neighborhood relationship and to avoid disadvantages as before, the design confines the semi-public open spaces in a small scale. Shared only by approximately ten households in the same apartment unit, every public yard is a lively open space between buildings. In this tiny open space, they negotiate and cooperate with their near neighbors for bicycle parking, public cleaning, safety, public plant maintenance, and other daily tasks. Every family has their own facilities and good privacy. Unlike most new developments, residents know each other very well and therefore form a favorable condition for crime surveillance.

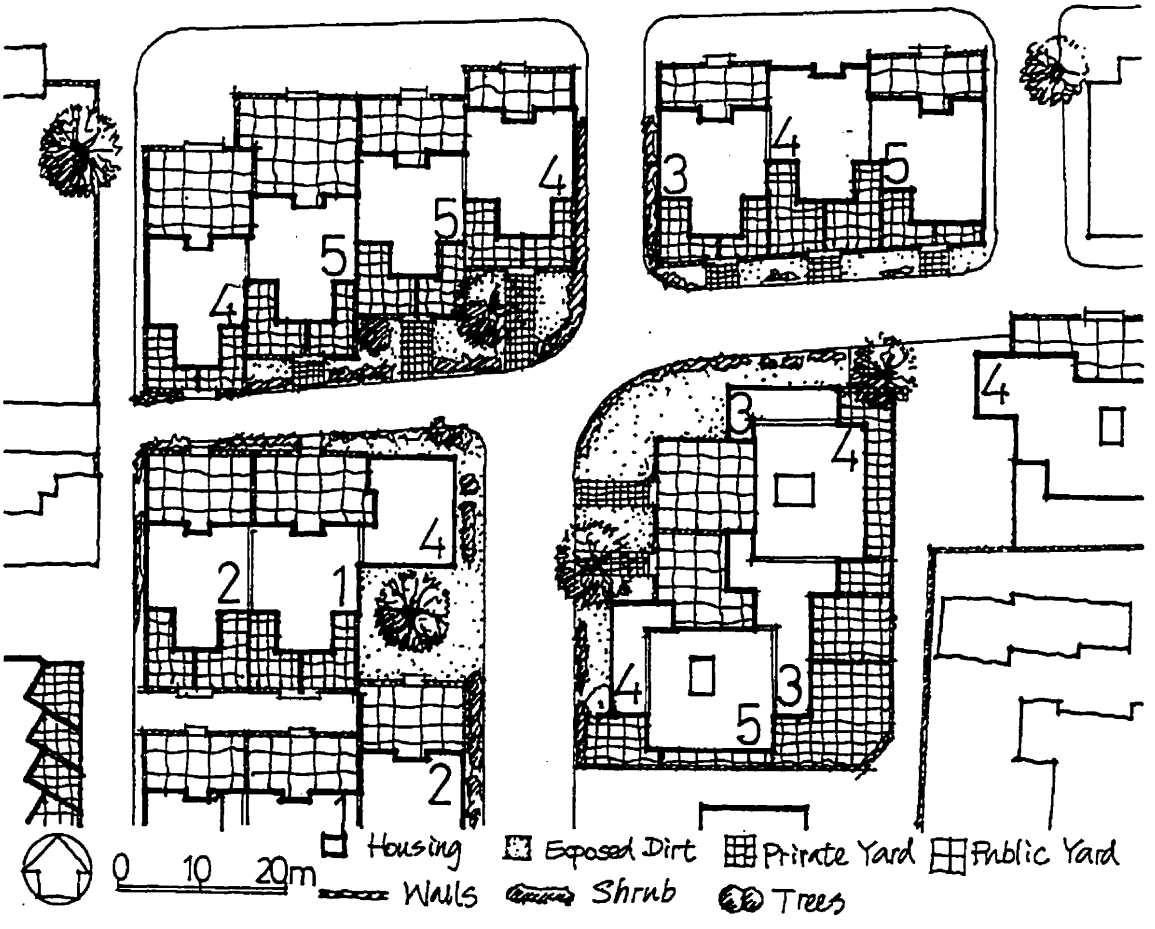


Figure 4.3.6 Space between buildings in Xiao-hou-cang

(source: Huang, 1991, p.50)

In the building design, the roof is kept the same curvature as that of the traditional roof. This helps to form a dynamic outline of the whole project seen from the nearby city primary streets. The brick walls of courtyards unify the street landscape and harmonize with surrounding neighborhoods. They are the backdrop for the people socializing, providing them with some sense of safety. They are also a kind of screen, keeping the noise out of yards and concealing the messy storage from street. Since buildings are not very high (on average four stories) and full of details, the scale of the street is quite intimate.

The project adopts a wise approach with regard to grass, trees and shrubs. Considering the relatively low budget of the development, low-cost maintenance will probably be inevitable in the future. Low maintenance plants and vegetation such as pine and shrubs are widely used instead of big patches of grass, which might be attractive at first, but sooner or later will be reduced to mud and dirt because of pedestrian traffic. In addition, the well-maintained old trees and plants, when arranged strategically, make the streets look green and lush.

Figure 4.3.7 View of a Small lane

On the negative side, lack of space and facilities for car parking, passive rest, and recreational activities are the main problem. The only public

Figure 4.2.8 Preserved trees

open space is occupied by motor vehicles (figure 4.3.10). Cars are seen everywhere beside the street. Since there is no open space for the children to play, except on the street, cars are a source of danger as well as disturbance. Even though the lane is used as a meeting place, little has been done to enhance the chance of social contact. Some residents bring their own benches, or find some used building material with which they can build a resting area. But for most of the street's residents, there is no place to sit down.

Figure 4.3.9 A Small lane re-furnished by residents

Figure 4.3.10 Public open space

Figure 4.3.11 Parked cars everywhere

Table 4.3 Xiao-hou-cang

XIAO-HOU-CANG				
Population density		815 people/ha.		
Building density (FAR)		1.3		
Year of completion		1990		
Site area		1.5 ha		
Land-use				
Site area		1.3 ha	100%	
Housing land-use (housing coverage)		0.85 ha (0.53 ha)	65.4 (40%)	
Green area land-use		0.08 ha	6.2%	
Road land-use		0.3 ha	23%	
Public service land-use		0.07 ha	5.4%	
Spatial hierarchy				
Public area		Lanes		
Semi-public(semi-private) area		Shared courtyards		
Private outdoor area		Private yards; balconies		
Space between buildings				
Type of space		Lane - courtyard pattern		
Number of apartments in one shared courtyard		4-20		
Building height		Mostly 3-5 stories (average 3.8 stories)		
Configuration of space		**Shared courtyard**	**North-south distance**	4-9m
			East-west distance	10-18m
		Width of lane	6-9m	
		D/H ratio	1.6	
Usable space	**Lane**	Circulation; social meeting; car parking		
	Shared courtyard	Bicycle parking; domestic work; relaxing; neighbor contact		
Unusable space	Not found			
Landscaping elements	**Paving materials**	Concrete blocks; concrete		
	Walls and fences	Gray brick walls with traditional gateways		
	Site furniture	Bulletin board; lamps;		
	Planting materials	Preserved old trees; evergreen shrubs		
Maintenance level		Normal		

Source: Huang, 1989, 1991; Visits to the project.

4.4 Case Study 4: *Juer hutong*

General Conditions

The site is located in the north part of inner city, only one block east of the central axis of Beijing. The historical sites of the Drum and Bell towers and Shi-sha-hai lake are in the vicinity. According to Beijing's master plan, this area is within the preservation scope of vernacular Courtyard Houses.

Various kinds of housing typology appeared here, including the traditional Courtyard Houses which are hundreds of years old, some slab mid-rise houses from the 1960's, and the simple constructions that were built during the time of the Cultural Revolution. In the original buildings, the average living area was very small. Some of the courtyards were more than eighty percent occupied by dwellings which were the shelters built by residents in the open spaces. Seriously lacking a water supply, sewer, drainage and sanitation facilities, *Juer hutong* was regarded as one of the areas most in need of renewal.

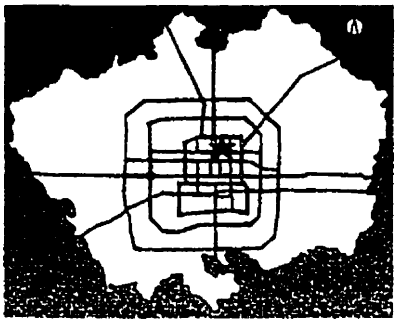


Figure 4.4.1 Location of the project

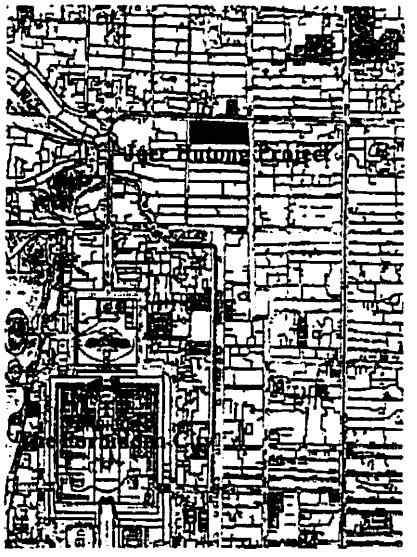


Figure 4.4.2 Urban fabric of old Beijing city
(source: Wu, 1994, p.83)

The project was designed by the research group from Tsinghua University headed by professor Wu, Liang-yong. A 'research and development' approach was followed in the phase-by-phase renewal process, a non-conventional process compared to other residential area development. Two out of four phases have been implemented between 1987 and mid-1994. So far, it has won several awards including the "1992 World Habitat Awards" as well as other national awards.

Planning and Design Features

The design concept was to create a new type of Beijing courtyard house to meet the modern living requirements, and in the meantime, to preserve the characteristics of the image of Beijing old city. The building layout and style are inspired by traditional Beijing Courtyard Houses.

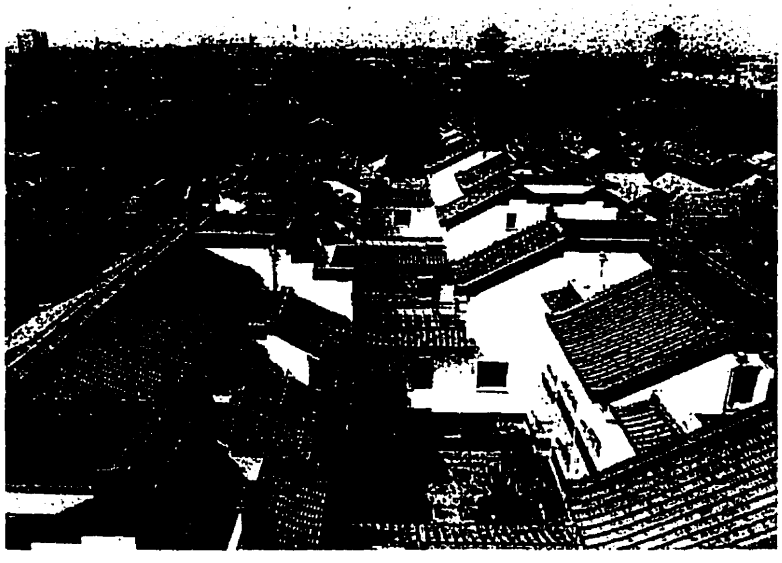


Figure 4.4.3 Bird-eye view of the project with Bell and Drum tower in the distance (source: BMUCCDO, 1995, p.108)

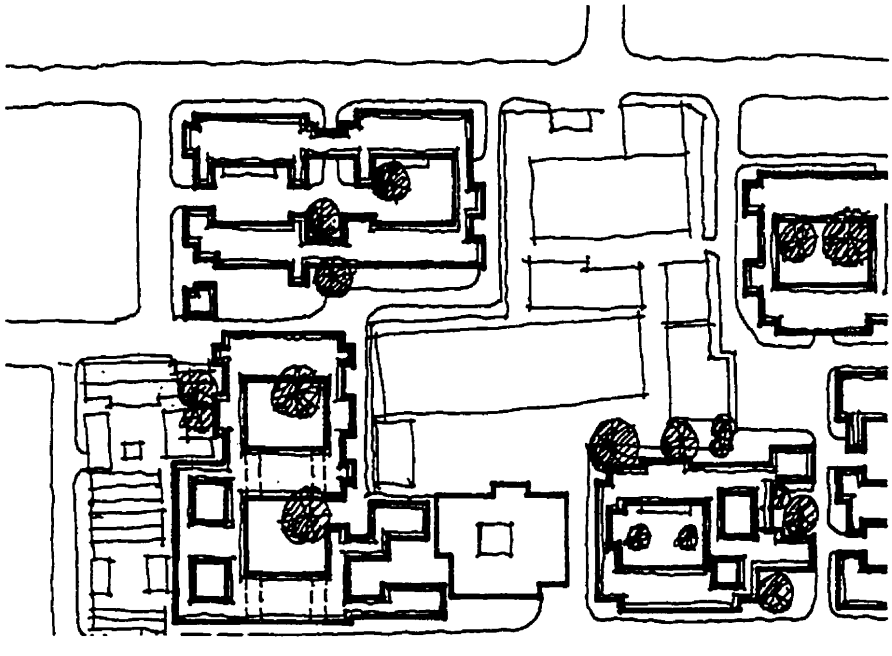


Figure 4.4.4 Plan of Juer hutong (source: Wu, 1994, p.135)

In the first phase (figure 4.4.5), a "typical yard", which is 13 meters wide and 15 meters deep, was conceived as a basic unit to make the whole area become sustainable and able to adapt to an irregular site. The east and west wing buildings are only two stories high in order to maximize the amount of sunshine available to the yard. The use of smaller, private, open yards on the ground floor, balconies, terraces and verandahs aim to give residents every opportunity to own semi-private open space.

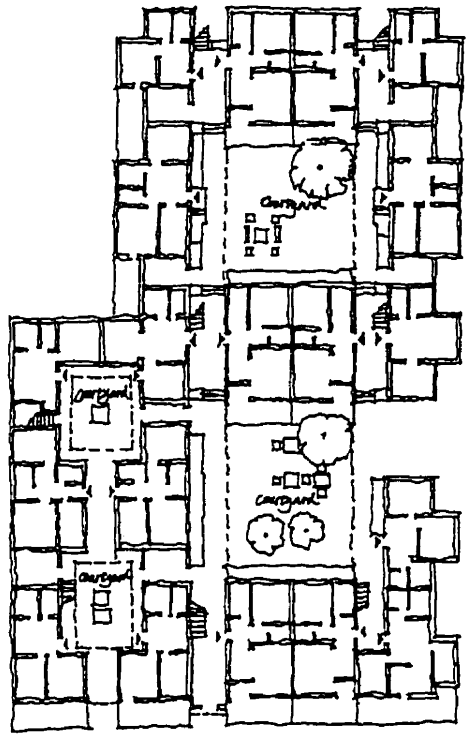


Figure 4.4.5 Plan of the first phase
(source: Wu, 1994, p.139)

In the second phase (figure 4.4.6), house construction on a larger scale was undertaken. The corridors which connected each yard in the first phase were moved from the inside to the outside of the courtyard, so as to form a more integrated circulation system, as well as to reduce the disturbance made from people passing through.

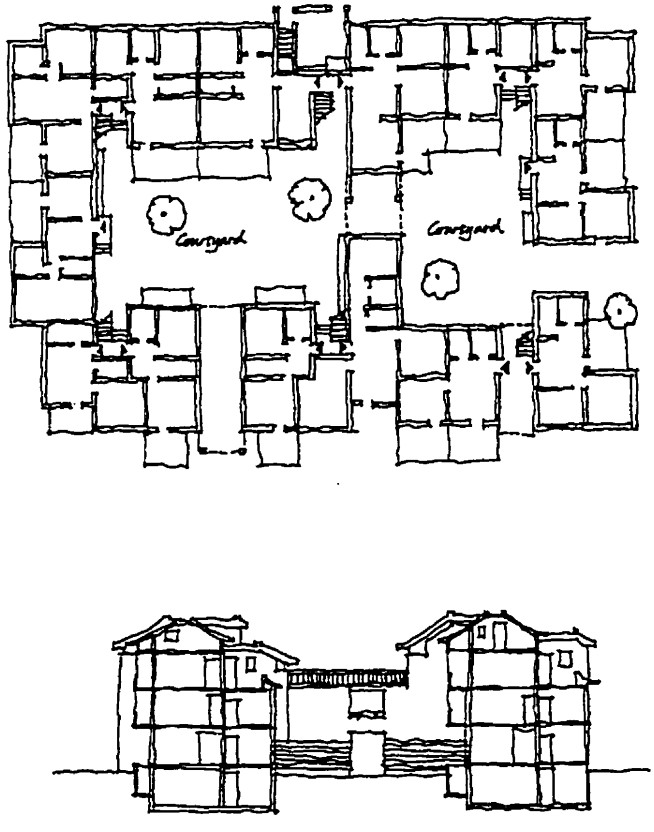


Figure 4.4.6 Plan and section of second phase
(source: Wu, 1994, p.142-143)

Observation and Analysis

Unlike conventional projects, the *Juer hutong* project borrowed from a traditional street layout and housing type in an effort to integrate the buildings into the urban fabric. To some extent, the project had initially explored some key issues in social, economic and environmental aspects in residential area planning and design in Beijing.

In the project, a hierarchy of space is apparently arranged along a main axis for each building cluster. As with the traditional arrangement, residents will gain access to their homes through a 'street - lane - courtyard - house' sequence. The sloped roofs, gray brick walls, red door panels, verandahs, trellises, old trees and square-pattern pavements recall the traditional flavor of the old Beijing houses.

The 'typical yards' and other small yards help to form semi-public areas that separate public lanes from private households. Upon stepping into the gateway, which leads to staircases and the yards, strangers might feel that they are intruding on this confined area. Even neighbors will sense the difference when entering another yard, since the appearance of buildings and landscape are not identical in every yard. Moreover, with fewer households sharing a common open space between buildings, residents are able to enjoy a greater feeling of security than in conventional mid-rise houses.

Figure 4.4.7 View of a typical yard

Whether examined in drawings or experienced on site, land-use is very efficient because all the spaces between buildings are either lanes or courtyards which are heavily used by passing people. Land without people, which is commonly found in conventional designs, does not exist in this project. There is no public green gathering area. Instead, courtyards accommodate as many usable spaces as possible, a feature that cannot be achieved in conventional designs.

The room layouts in the apartments are similar to those in regular mid-rise housing, while the major improvement of the project is the organization of outdoor spaces. The gateway and corridor are low in height with buildings or balconies overhead. In contrast, the typical yard is relatively wide and open, although some side yards are in smaller in size. These floating outdoor spaces are in various scales and shapes, providing rich visual pleasure and spatial experiences.

Figure 4.4.8 View of a yard

With a relatively low building height and many design details, the project is human in scale. Each dwelling unit can enjoy adequate sunshine, good ventilation and a pleasant view over at least one courtyard. The residents have visual contact with plants, and can easily supervise their children playing inside the courtyard.

Nevertheless, some problems relate to the usage of the courtyard. Although the courtyards look intimate and inviting at first glance, they are devoid of relaxing people and entertainment activities, characteristics observed in old neighborhoods. People just pass through them or have chat around gateways. This can be attributed to inappropriate design.

The courtyard is slightly too small in size for neighbors to be able to socialize with each other in comfort. The sound of voices can be heard in every corner, even from inside. In the courtyard, one may feel exposed and in the public gaze, since every detail of one's movements can be viewed from windows and balconies. With a similar size to the traditional courtyard which was owned by only one family and surrounded by single-storied houses, the new courtyard, which is shared by 10 to 30 households and surrounded by three or four storied buildings, functions in a different way. Practical uses such as bicycle and car parking, domestic activities, and children playing are more appropriate for the courtyard than socializing which is the main design objective. Correspondingly, the treatment of the courtyard has to be changed. Facilities for parking and children playing, more households owning private yards, and more greenery could be seen as alternatives. Furthermore, the small size of the public courtyard causes other side effects, such as privacy encroachment. Many residents have to keep their curtains closed even in daytime, and first floor owners usually don't have enough buffer space to cut off unpleasant visual intrusions.

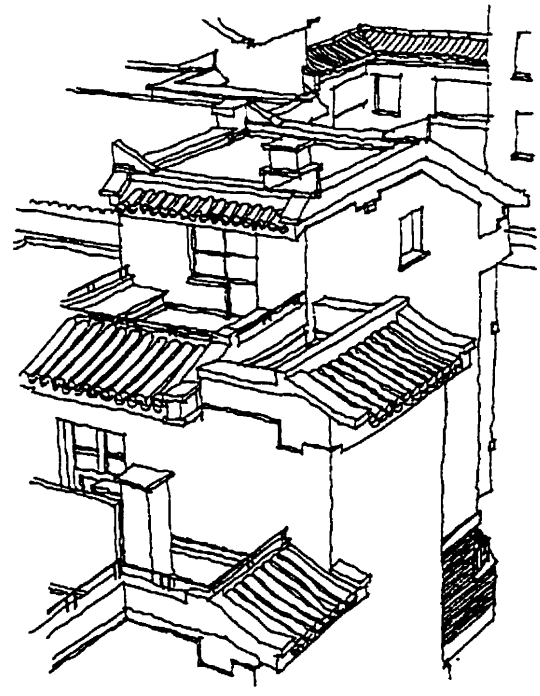


Figure 4.4.9 The rhythm of roofs

Table 4.4 ***Juer hutong*** **(phase 1 & 2)**

JUER HUTONG (PHASE 1 & 2)				
Population density		523 people/ha.		
Building density (FAR)		1.32		
Year of completion		1989 (phase 1); 1994 (phase 2)		
Land-use				
Site area		1.255 ha	100%	
Housing land-use		1.145 ha	91.2%	
Road land-use		0.04 ha	3.2%	
Other		0.07 ha	5.6%	
Spatial hierarchy				
Public area		Lanes		
Semi-public(semi-private) area		Shared courtyards		
Private outdoor area		Private yards; balconies; roof terraces		
Space between buildings				
Type of space		Lane - courtyard pattern		
Number of apartments in one shared courtyard		8-25		
Average building height		2.9 stories (basement not included)		
Configuration of space		**Shared courtyard**	**Typical courtyard**	13m x 15m
			Small courtyard	4.5m x 6m
		Width of lane	6m (preserved old lane)	
		D/H ratio	1.6	
Usable space	**Preserved lane**	Circulation; social meeting		
	Shared courtyard	Bicycle parking; domestic work; relaxing; neighbor contact		
Unusable space	Not found			
Landscaping elements	**Paving materials**	Concrete blocks (patterned pavement)		
	Walls and fences	Gray brick walls with traditional gateways		
	Site furniture	Flower pools; verandahs; trellis; lamps;		
	Planting materials	Preserved old trees; flowers		
Maintenance level		Good		

Source: Wu, 1994; BMUCCDO, 1995; Visits to the project.

4.5 Case Study 5: *Ta-yuan*

General Conditions

Ta-yuan small district occupies a long, narrow strip of land in the southern part of the city, approximately 12 kilometers from the central district. Two city streets are located both on the south and north edges, and on east and west sides there are residential areas.

This prizewinning project was designed by the school of architecture of Tsinghua University. Held in 1980, this competition intended to encourage architects to move away from monotonous designs and design a more interesting and congenial living environment. This competition received as many as 72 proposals, and shed new light on the design of residential area of that time.

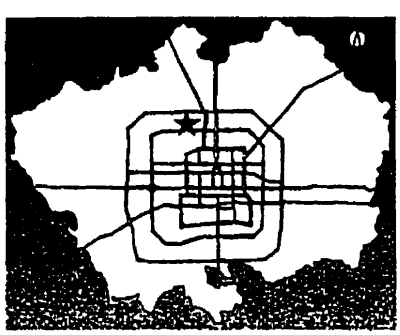


Figure 4.5.1 Location of the project

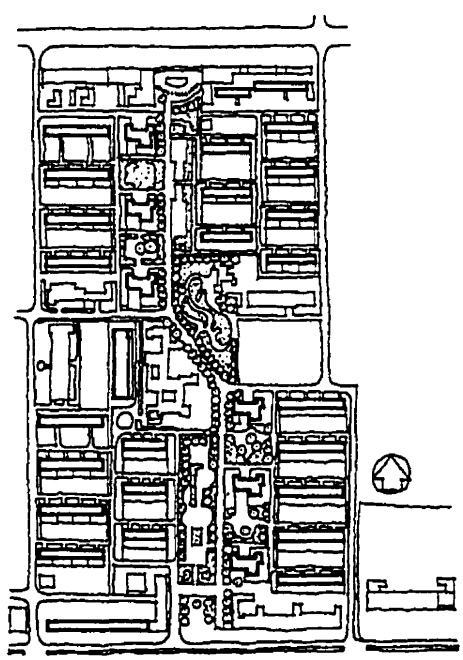


Figure 4.5.2 Plan of Ta-yuan Project (source: Zhu, 1996, p.145)

Design Features

The roads divide this small district into four housing groups. Medium-rise houses are six story slabs. High-rise houses are 12 to 18 story point blocks and slabs. The main idea of this design was to create a diversity skyline of the district by strategically arranging mid-rises and high-rises. In the effort to break up the monotonous row layout, mid-rise buildings were designed to avoid into alignment with the other column. Green spaces are grouped along the main road, in order to be accessible by the largest number of residents possible.

Observations and Analysis

A fundamental part of this project is the design of large numbers of public green spaces. Enclosed by railings, trees and shrubs, the open spaces which people use most are located away from vehicular traffic, and are therefore tranquil and inviting. Running throughout the whole district, the linear public green spaces are heavily used by the residents from every housing group.

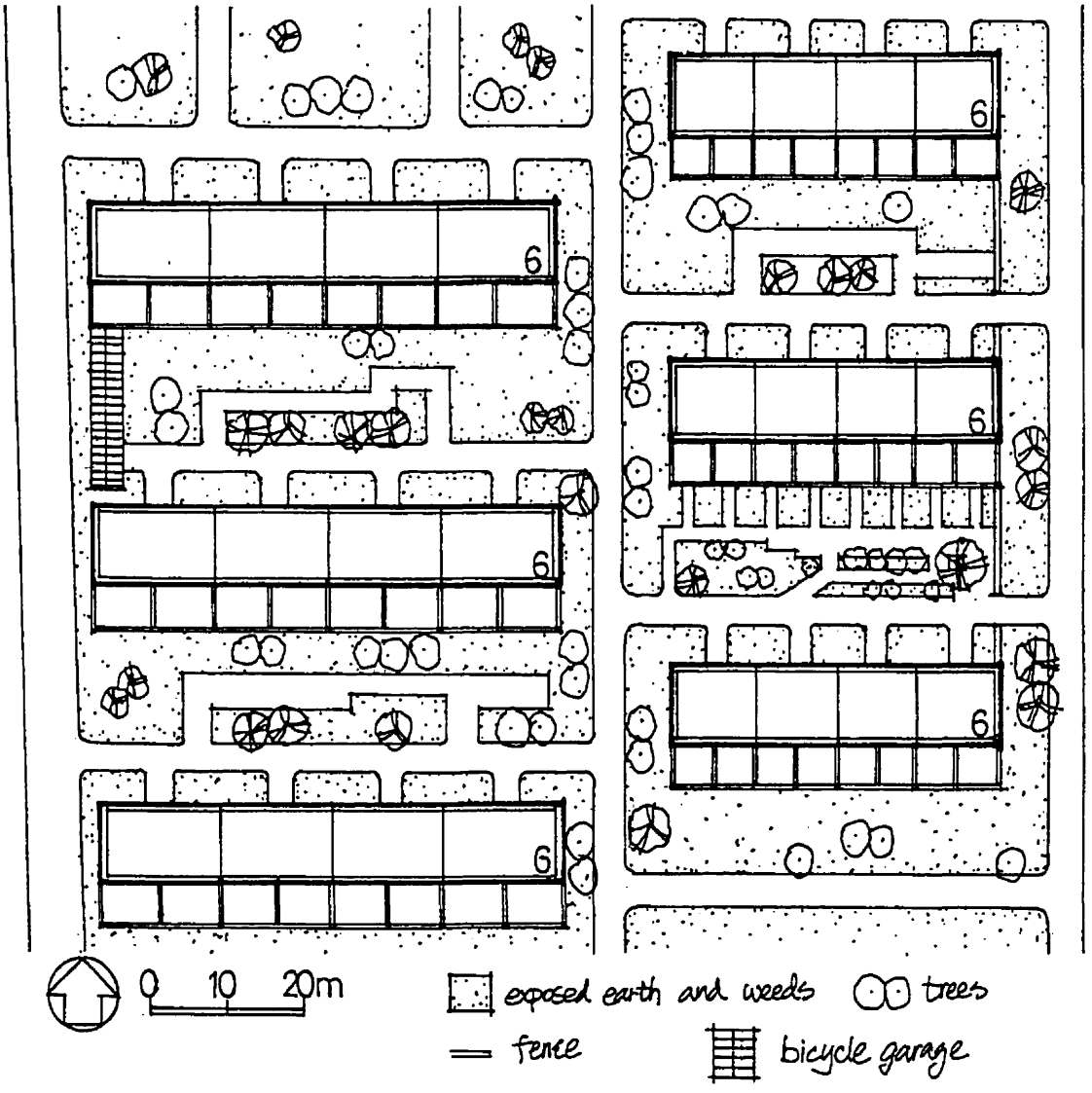


Figure 4.5.3 Space between buildings in Ta-yuan

(source: Zhu, 1996, p.145)

Although a symbolic fencing wall was created at on the end of two buildings, there is no sense of enclosure in the housing group. Since the entry roads to each building connect directly to main roads, every space between buildings is open to the public. Strangers can access the buildings very easily, and passing pedestrians can take many alternate shortcuts through the housing group. As a result, residents feel less ownership for this supposed semi-private territory.

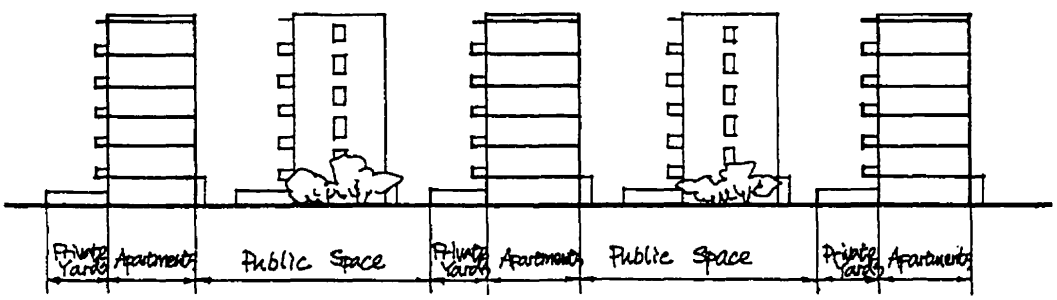


Figure 4.5.4 Section of Spaces between buildings

In every housing group, there is only one bicycle storage house which was apparently added some time after the completion of the project. Thus, the only designated parking space is too small to accommodate all the bicycles, with the result that bicycles are parked everywhere in the spaces between the buildings. Small lobbies of apartment buildings provide alternative parking spaces when it rains. Cars and small trucks have no place to park, but are scattered in the spaces between buildings.

Figure 4.5.5 Fencing wall and entrance of Space between buildings

Between houses are, large patches of zigzag-edged land which are the designated green areas. Today, there is no more grass, but only hard earth with trees and sparse weeds growing here and there. Most of these patches of land are neglected and nobody tends to use them in any way.

Figure 4.5.6 View of space between buildings

Figure 4.5.7 Neglected space between buildings

Figure 4.5.8 View of space between buildings

Table 4.5 Ta-yuan

TA-YUAN			
Population density		648 people/ha.	
Building density (FAR)		1.325	
Year of design		1980	
Land-use			
Site area		16.14 ha	100%
Housing land-use*		8.9 ha	55%
Green area land-use*		1.8 ha	11%
Road land-use*		1.0 ha	6%
Public service land-use*		4.5 ha	28%
Spatial hierarchy			
Public area		Community green area; main road; spaces between buildings	
Semi-public(semi-private) area		Not defined	
Private outdoor area		Private yards; balcony	
Space between buildings (mid-rises only)			
Type of space		Open space	
Number of shared apartments		48-54	
Building height		6 stories (& 10 - 20 story high-rises)	
Configuration of space		**North-south distance**	29m
		East-west distance	38-55 m
		D/H ratio	1.6
Usable space	**garage**	Bicycle parking; not enough room	
Unusable space	Supposed green area between buildings		
Landscaping elements	**Paving materials**	Concrete blocks; concrete	
	Walls and fences	Lattice walls	
	Site furniture	Not found	
	Planting materials	Trees; bushes	
Maintenance level		Poor	

Source: Zhu, 1996; BMUCCDO, 1980-1989; Visits to the project.

* Figures are estimated by writer without confirmation.

4.6 Case Study 6: *Huai-bai-shu*

General Conditions

The site is located at the western edge of old city, next to the Art Garden of the Xuan-wu district. The *Huai-bai-shu* street was the main east-west street which connected several north-south lanes. Old and dilapidated single story houses were the main existing housing type. The project is part of the urban renewal program conducted by the municipal government. It was in two phases. The first phase which is to the south of *Huai-bai-shu* street, was constructed between 1990 and 1992, while the second phase, which is to the north, is still under construction. After the completion of first phase, ninety percent of the original residents moved back to the site.

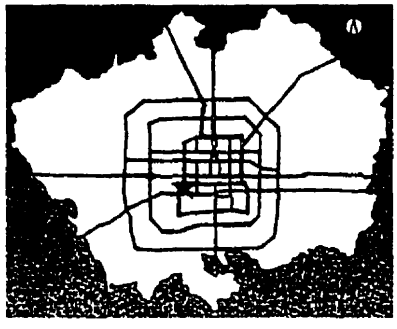


Figure 4.6.1 Location of the project

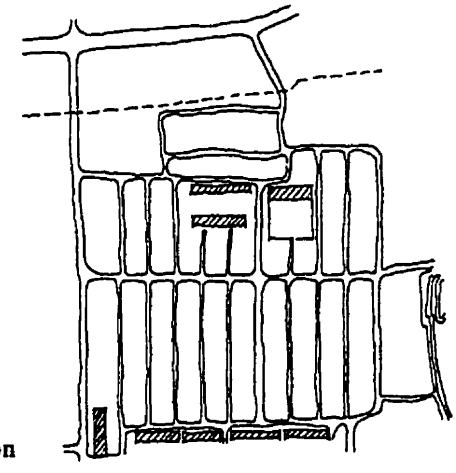


Figure 4.6.2 Existing condition (source: Liu, 1991, p.9)

Design Features

The main idea of the design was to preserve the street-lane-courtyard pattern of the old community. After the renewal, *Huai-bai-shu* street and two wider lanes were rebuilt and used as the main roads of the new project; whereas the remainder of the small lanes disappeared. In the housing group, winding spaces were intended by the architect to resemble the courtyards of traditional houses (Liu, 1991). Along main roads, four-to-six-story walk-up apartment buildings are arranged uniformly like enclosed walls, around the site. Almost one third of the apartments are east-west oriented. The houses have sloped roofs, two stories lower on the north side. More gentle than the angle of the sun, this sloped roof helps to save land by reducing the sun-light distance.

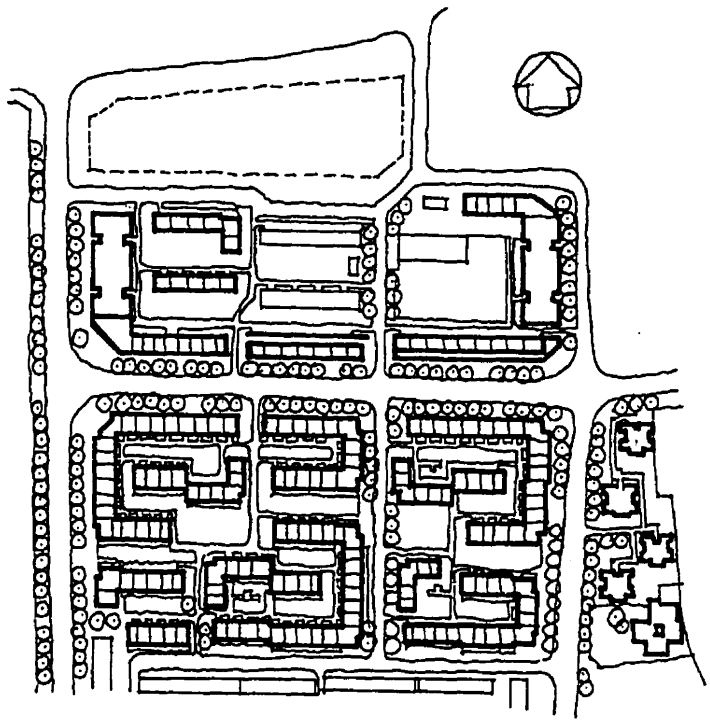


Figure 4.6.3 Plan of Hai-bai-shu project
(source: Liu, 1991, p.8)

Observations and Analysis

The project appears enclosed from the outside due to its wall-like building layout. From inside, the configuration of space varies between each housing group; some are long and narrow, and some are square. However, since these spaces do not have a hierarchical order and leave gaps which are open to the public, intermediary areas cannot be found. As a result, uncontrolled access to every housing group poses a threat to the security of the residents.

The true flavor of traditional courtyard houses cannot be recalled in the project as the architect hoped, either in the physical environment, or in the customs and characteristics of life in the old neighborhood where there were spaces between buildings. The sloped roof doesn't have the same curve and shape as the old courtyard houses, and buildings are much taller, up to six stories, particularly on the south side. In some places, the building height is the same as the distance between the buildings, giving a feeling of overcrowding. Private yards are so small that most of the residents convert them into a small extra room, and many first floor units don't even have private yards. The human

scale of the lanes and courtyards is non-existent and thus the preservation of the spatial pattern of the old community is out of the question.

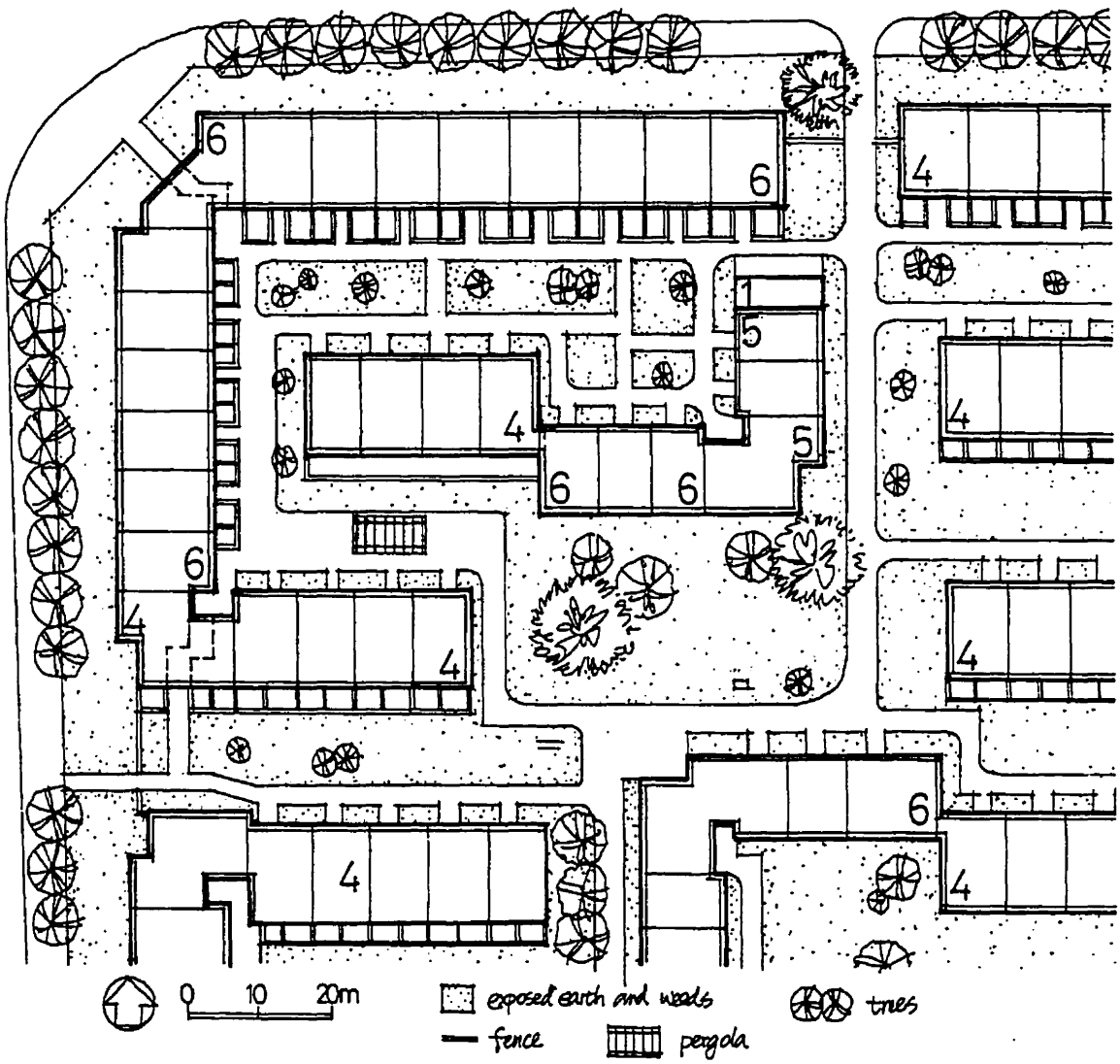


Figure 4.6.4 Spaces between buildings in Huai-bai-shu
(source: Liu, 1991, p.9)

The standard six-story apartment housing with standard layouts was built around common spaces shared by a number of apartments. Except for the necessary building entry roads, the rest of the land is raised and left with exposed earth, with one or two trees here and there. These patches of raised land are designed as the green areas, as in most of the conventional designs. In practice, however, they are not adequate or convenient for

the diverse activities that the residents carry out there, and they ultimately become outdoor storage places. Although there are some bicycle garages located in the basement of buildings in each housing group, bicycles are found everywhere in the outdoor space. It seems that the underground garage is not easily accessible. There is not a single outdoor bicycle shed which could be used as alternative parking. In addition, there are no parking lots built into the design, resulting in cars parked randomly around the buildings. Bicycles lean against trees, vegetables are piled, quilts and clothes hang on trees and evidence of other domestic activities show how the space has been wasted and misused. In contrast, with the cramped spaces between buildings, the public green area is wide open. Apart from some trees, the green area isn't green but just bare earth. It is simply too large to be used regularly by the residents, and so has been abandoned.

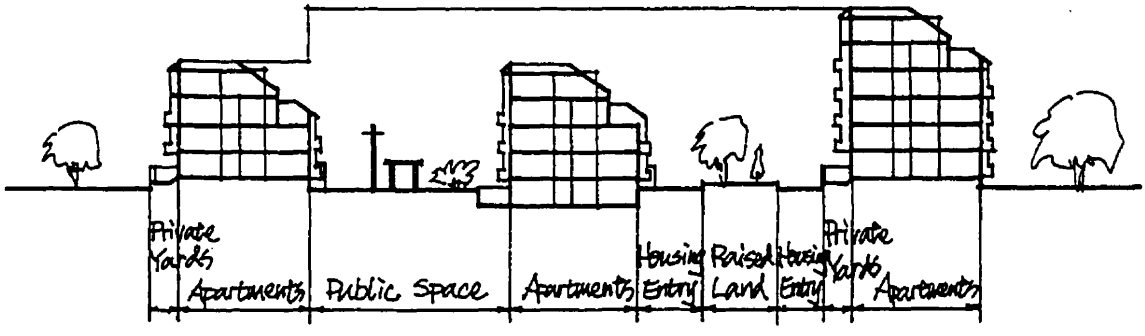


Figure 4.6.5 Section of spaces between buildings
(source: Liu, 1991, p.10)

Besides some preserved trees along the road and a few trees between buildings, the landscaping of the site is very poor. There are a few pieces of site furniture, a single trellis, and a set of parallel bars. There are no benches or recreational facilities, but despite this, people try to take advantage of every opportunity for recreation and amusement. For example, a group of residents was taking (see figure 4.6.11) turns at playing table tennis on an informal table made by themselves.

Figure 4.6.6 Overcrowding in space between buildings

Figure 4.6.7 Open and unused public space

Figure 4.6.8 View of space between buildings

Figure 4.6.9 View of space between buildings

Figure 4.6.10 Domestic activities in space between buildings

Figure 4.6.11 Two residents playing table tennis

Table 4.6 ***Huai-bai-shu*** **(phase 1)**

HUAI-BAI-SHU (PHASE 1)			
Population density		640 people/ha.	
Building density (FAR)		1.639	
Year of completion		1992	
Land-use			
Site area		11.41ha	100%
Housing land-use*		9.0 ha	79%
Green area land-use*		0.6 ha	5%
Road land-use*		0.8 ha	7%
Public service land-use*		1.0 ha	9%
Spatial hierarchy			
Public area		Community green area; main road; spaces between buildings	
Semi-public(semi-private) area		Not defined	
Private outdoor area		Private yards; roof terrace; balcony	
Space between buildings			
Type of space		Partially enclosed space/ strongly enclosed space	
Number of shared apartments		96-262	
Building height		4-6 stories	
Configuration of space		**North-south distance**	19-29m
		East-west distance	55-77 m
		D/H ratio	1-1.6
Usable space	?		
Unusable space	Supposed green area between buildings		
Landscaping elements	**Paving materials**	Concrete blocks; concrete	
	Walls and fences	Gray brick walls	
	Site furniture	One pergola; one set of parallel bars	
	Planting materials	Trees; bushes	
Maintenance level		Poor	

Source: Liu, 1991; Broudehoux, 1994; Visits to the project.

* Figures are estimated by writer without confirmation.

Chapter 5
Analysis and Conclusions

5.1 Design Concept for Space Between Buildings

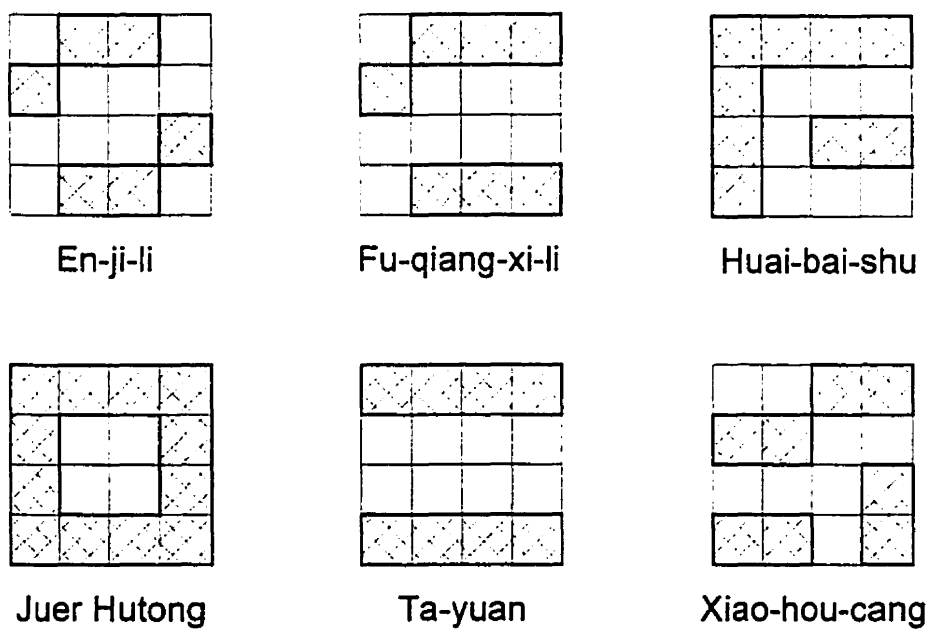


Figure 5.1 Diagram of Space Between Buildings

The case-study designs illustrate different concepts of space between buildings (figure 5.1). In *Ta-yuan*, the row pattern of buildings is the conventional approach to residential planning that reflects the ideas represented in modern architectural movements. Although reflecting the requirements of current zoning regulations, this type of concept fails to define the territory of open space. Buildings become freestanding objects and as a result, open spaces around buildings become vacant. The designs of *Fu-qiang-xi-li* and *En-ji-li* attempted to create enclosed open spaces on a housing-group scale. In this group pattern concept, buildings are one of the elements used to enclose space, and spaces between

buildings are well defined as semi-public or semi-private areas. *Huai-bai-shu* has a similar layout, but functions less efficiently. The other two projects have explored some innovative design concepts by reconsidering the basic planning principles. Both are inspired by traditional neighborhood design, and each addresses different design aspects. *Xiao-hou-cang* focuses on the preservation of old street patterns and images, while *Juer Hutong* introduces a brand new type of housing with respect to vernacular courtyard houses. While upholding traditional neighborhood concepts, the spaces creating in these projects are not only intimate but also well integrated into their surroundings. It is worth mentioning that in these two projects, we see only small-scale outdoor spaces as opposed to the conventional design approach of large open spaces.

5.2 The Layout of Space Between Buildings

The projects in the case studies have shown different design approaches in the physical organization of space between buildings. Three physical aspects that reflect the characteristics of the design are chosen to be the assessment topics.

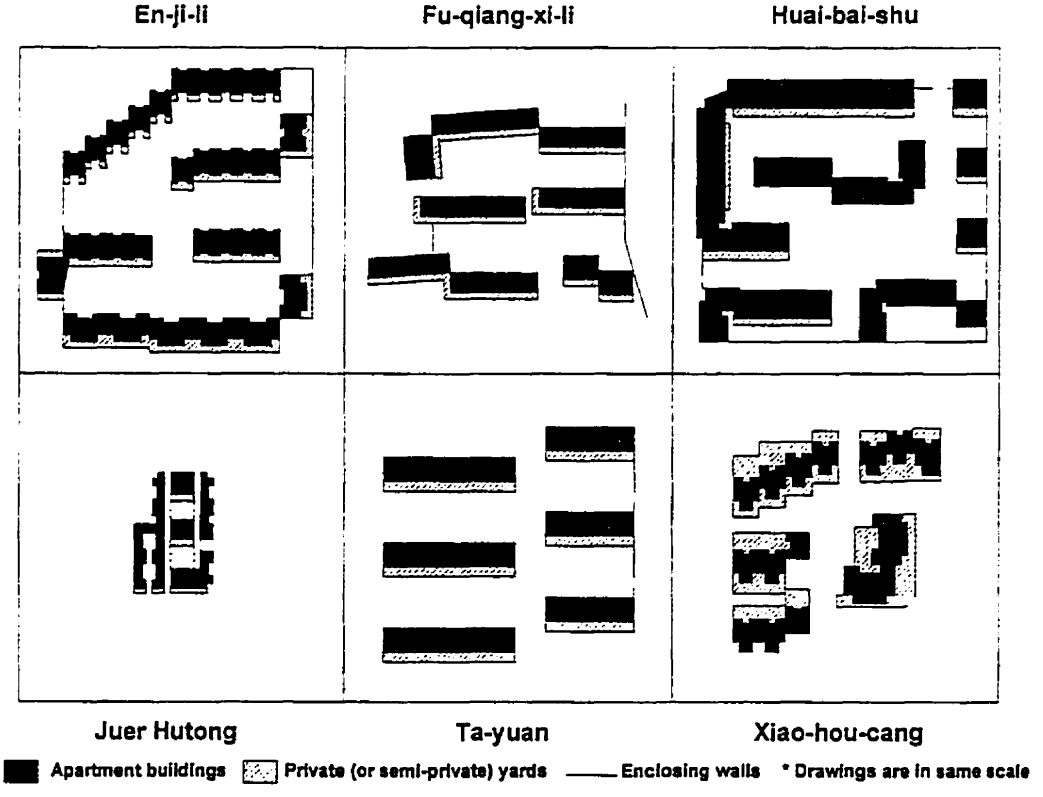


Figure 5.2 Comparative Diagram Showing the Six Cases in the Same Scale

Spatial Order

The case studies show how several levels of privacy can be achieved through outdoor spaces. The main roads and communal green areas are the very public spaces which belong to all the residents in the residential or small districts. Spaces between buildings shared by many households are places where semi-public and semi-private spaces are located. Private yards, balconies and even roof terraces are private domains attached to apartments. Nevertheless, not all the projects achieve the hierarchical order of outdoor spaces. In *Ta-yuan* and *Huai-bai-shu*, spaces between buildings are not well defined and access from the very public area is not controlled. In *Fu-qiang-xi-li* and *En-ji-li*, even the spaces between buildings are enclosed as semi-public areas; the spaces are needed to be sub-divided into semi-private places. *Xiao-hou-cang* and *Juer hutong*, with their traditional lane and courtyard layout, are good examples of spatial order. In these cases, residents enjoy semi-public as well as semi-private outdoor spaces where they achieve social contact on several different levels, as they wish.

The opening between paralleled housing, since the opening is too wide, does not define the interior from exterior, like the case in *Huai-bai-shu* and *Ta-yuan*. To define the territory of space between buildings, there should be some treatments to form a visual or symbolic boundary line. Enclosing a wall with a gate (as in *Xiao-hou-cang*), interlocking buildings (as in *Fu-qiang-xi-li*), a bridge between buildings (as in *Juer hutong*), and even plantings will help.

Degree of Enclosure

Classified by the degree of enclosure, three general typologies of space layout are found in the case studies: open, enclosed, and lane-courtyard layout. The open space between buildings, such as in *Ta-yuan*, features wide openings to the public access roads between both ends of two parallel rows of apartment buildings. In the enclosed space between buildings, such as in *Fu-qiang-xi-li* and *En-ji-li*, a sense of partial enclosure is achieved by putting some east-west facing buildings at both ends of the yard, or simply recessing the end units of slab buildings. A strong feeling of enclosure can be found in the

courtyards of *Xiao-hou-cang* and *Juer hutong*, both intended to resemble the lane-courtyard pattern of the traditional neighborhoods.

In the open layout, since it is difficult to prevent the unwanted pedestrian or cyclist from trespassing, resident surveillance of the trespassers cannot be effective, and the safety of the children playing just downstairs cannot be ensured. In contrast, in enclosed and lane-courtyard layouts, there are usually a limited number of entries to the housing group from outside. With this design, delinquents are not able to escape easily. Since housing entries of both rows of buildings are facing the enclosed area, there are more people arriving and leaving the area, and this constant activity makes safer for the residents. In the meantime, social contact among neighbors increases. However, as in *Fu-qiang-xi-li*, where there is no housing entry in the space between buildings, the buildings are more likely to show signs of decay, and it could be a dangerous place for residents. In *En-ji-li*, this problem is alleviated by combining several pairs of buildings together as a housing group. Inside the housing group, almost every space between buildings is used by residents from at least one building. The walls of public yards in *Xiao-hou-cang* form not only the enclosure of yards but the edges of streets. In *Juer hutong*, the centripetal courtyard is a building-surrounded space. These lane-courtyard layout projects have their inherent advantages with respect to safety and social contact. However, some problems concerning privacy may occur if the courtyard is shared by too many households. Apart from private yards, the number of apartments sharing a courtyard range from under ten to more than twenty in both projects. The fewer households, the more privacy is available to the residents.

The main difference in the configuration among these three typologies of space are in the east-west oriented buildings. In the open layout project, there is only north-south oriented housing which reflects the welfare-housing concept of the socialist distribution system. In the enclosed layout project, the east-west facing housing varies in the numbers of entrances and building height. In *Fu-qiang-xi-li*, three out of approximately 20 entrances are east-west facing buildings in each housing group, and they are all four stories high. In *En-ji-li*, there are two or three out of around 30 entrances in each housing group, and

building heights are from three to five stories. In *Huai-bai-shu*, this ratio is much higher. Almost one third of entrances to buildings are east-west facing, and they are almost all six stories in height. Compared to the feeling of partial enclosure in the first two projects, spaces between buildings were felt to be isolated in *Huai-bai-shu*.

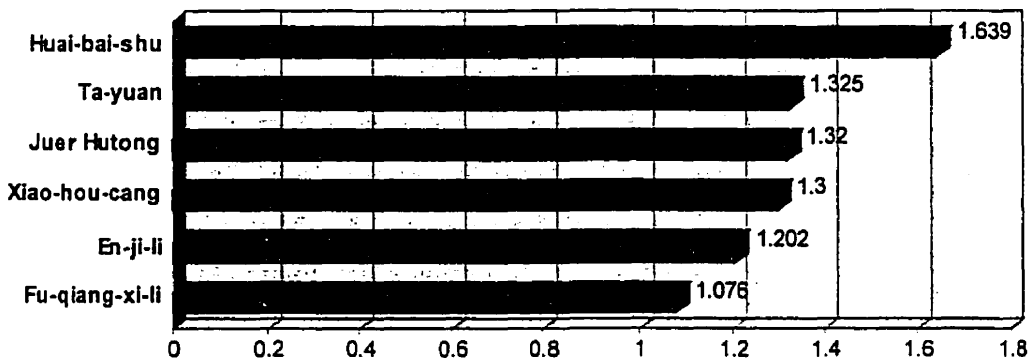


Figure 5.3 Building Density (FAR)

The degree of enclosure also has a great impact on the building density of the project (figure 5.2). Despite the fact that 55.5 percent of the floor areas are high-rises, and mid-rises are all in six stories, with an open-plan layout, *Ta-yuan* doesn't have the big advantage in FAR that it should have as a high-rise residential area. On the contrary, although buildings are, in most cases, between three to five stories because of their east-west orientations, *Xiao-hou-cang* and *Juer hutong* can also reach a competitive building density. Under similar conditions, the more enclosed the space, and the more east-west oriented buildings, the higher the building density.

Spatial Scale and Proportion

In the case studies, scale of space can be observed through the following three elements: building height, spatial size, and the number of households sharing the space.

Although the buildings studied are all medium rise, they still encompass a wide range in height, from two stories to six stories (figure 5.2). Projects built in the old city contain more housing at the lower end of the scale, according to the municipal bylaw. Most of the

east-west oriented buildings turn out to be lower than those oriented north-south. This kind of treatment is intended to introduce more sunshine into the inner space, and to reduce the possible visual isolation of the enclosed space.

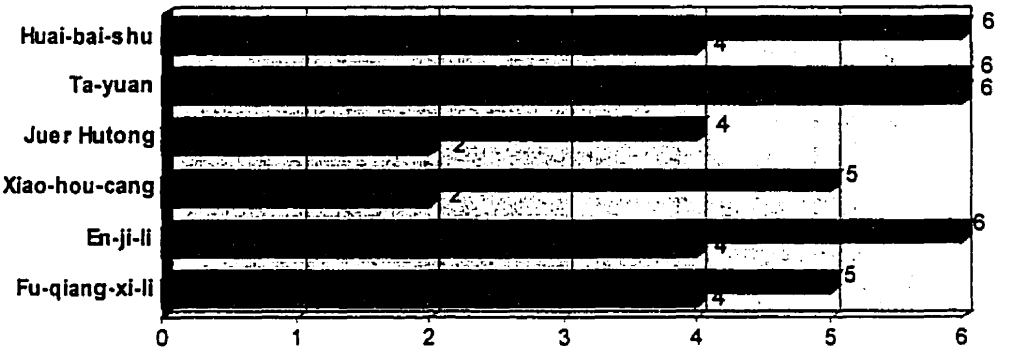


Figure 5.4 The Highs and Lows of Building Height of Mid-rises (in stories)

The distance between two north-south oriented buildings is primarily decided by the height of the south building, according to the sunlight distance regulation. In the east-west direction, where there is no regulation to follow, it varies significantly from one project to another (figure 5.3). The longest is found in *Fu-qiang-xi-li,* being 170 meters; the smallest is in *Juer hutong*'s small courtyard, which is just six meters wide.

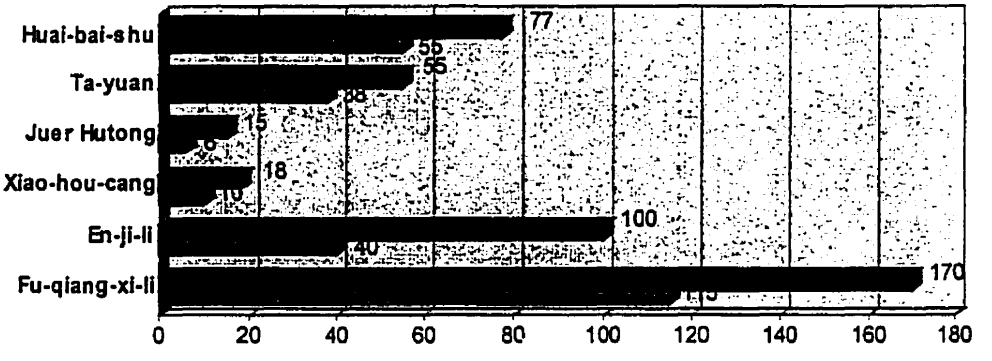


Figure 5.5 The Highs and Lows
of East-west Distance of the Space Between Buildings (in meters)

The scale of the space between buildings can also be measured through the number of households sharing the space. This sharing relationship refers to the common ownership of the space. The fewer shared households, the more sub-division of the neighborhood, the more controllable space for the residents. In some cases, the shared residences are in one entrance such as in *Xiao-hou-cang*; in some cases, the shared residences are from one building as in *Ta-yuan*; other cases like in *Fu-qiang-xi-li*, residents in all the buildings surrounding the inner space share the space. Relatively speaking, enclosed layout has the highest number of sharing households and lane-courtyard type of projects has the smallest scale of any neighborhood (figure 5.4).

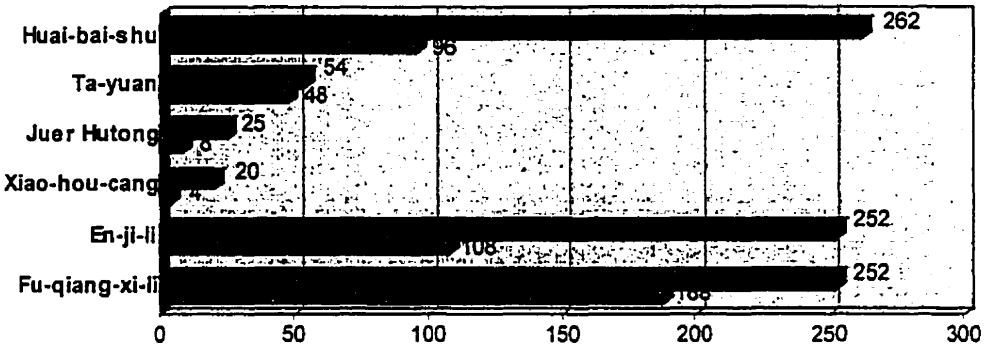


Figure 5.6 The Highs and Lows of Households Sharing a Space Between Buildings

The proportion of space is related to the ratio of spatial distance to building height. The ratio of the spatial distance to the southern building is always kept as 1.6 to 1.7, in order to make full use of land according to the sunlight distance regulation. However, in the case that the northern-facing building exceeds two more stories than the southern-facing building, the D/H ratio from the north is below 1, which indicates that the space may cause a feeling of oppression, like in *Huai-bai-shu* where four-story and six-story buildings are put together.

The lower building height results in the relatively high proportion of ground-related dwellings with private outdoor yards. It also allows residents enjoy and appreciate the plants and shrubs planted in the yards. Smaller spaces with a good proportion from both

south and north sides (D/H ratio between 1 and 2) will give residents a good overview of the exterior spaces, especially the children's playground. Smaller neighborhoods will provide a greater feeling of security, and self-surveillance will be more feasible. Through scale control in the design process, a humanized space between buildings will be established.

5.3 Functional Arrangement of Space Between Buildings

The space between buildings should accommodate the everyday requirements of the residents as much as possible, especially in Beijing where residents' interior spaces and private exterior spaces are limited, restricting domestic work and outdoor recreation. As the case studies reveal, basic functional facilities for outdoor living are missing in many projects. Residents have to either adapt to existing conditions, or give up certain activities. The following analysis is to give future designers a checklist of the functional facilities for three kinds of basic outdoor activities: pedestrian activities, domestic activities, and vehicle movement and parking.

Pedestrian Activities

Table 5.1 Functional Facilities for Pedestrian Activities

	Fu-qiang-xi-li	En-ji-li	Xiao-hou-cang	Juer-Hutong	Ta-yuan	Huai-bai-shu
No detour road	✓	-	✓	✓	✓	✓
Lit-up access road	-	★	✓	✓	✓	-
Outdoor sitting places everywhere	✓	✓	-	✓	-	-
Waiting area at housing entry	✓	✓	✓	✓	-	-
Small gathering place with benches	-	★	-	★	-	-
Sunny area with tree shading	✓	✓	✓	✓	✓	✓
Children's play area	-	-	-	-	-	-
Barrier-free facilities	-	✓	-	-	-	-
Comparative overall evaluation	✓	★	✓	★	-	-

★: good design ✓: average design -: bad design
Source: Visits to the projects.

Pedestrians should be given priority for the use of the space between buildings. The facilities to support their movement should be convenient, safe and pleasant. The case studies reveal some apparent problems in design (table 5.1). The access roads of two projects (*Huai-bai-shu* and *Fu-qiang-xi-li*) which don't have street lamps could be dangerous for the residents and inconvenient for visitors at night. Most of the projects (four out of six) don't have enough places and facilities to accommodate social contact among residents, and sitting areas around the buildings are inadequate. While all the projects give residents an opportunity to enjoy the benefits of sunshine and trees, man-made amenity areas such as children's playing areas and barrier-free facilities are seriously lacking. For example, not a single sandbox exists in any of the six projects. Children play everywhere, but they must be given defined spaces where they can play and exercise in safety. These playgrounds should be sheltered and open to the sun. Unfortunately, play space is not even considered by most designers.

Outdoor Domestic Activities

Table 5.2 Functional Facilities for Outdoor Domestic Activities

	Fu-qiang-xi-li	En-ji-li	Xiao-hou-cang	Juer-Hutong	Ta-yuan	Huai-bai-shu
Clothing airing	-	-	-	✓	-	-
Private gardening	-	✓	✓	✓	✓	-
Buffer zone for various repairing	✓	✓	✓	✓	✓	✓
Comparative overall evaluation	-	✓	✓	★	✓	-

★: good design ✓: average design -: bad design
Source: Visits to the projects.

Many household tasks have to be done in public outdoor spaces due to both the lack of adequate indoor space and to the nature of the work. Clothes airing, bicycle repair, and stove vent cleaning are often seen in progress at most sites in these projects. In *Huai-bai-shu*, other than the road, private storage occupied most of the space between buildings. In all the projects except *Juer hutong*, which has hanging bars in the courtyard for clothes

airing, people have to tie ropes between two trees. Even an initiative as simple as putting up a few posts in a piece of open space with sunshine, would provide a great deal of help to people doing housework. In two projects (*Fu-qiang-xi-li* and *Huai-bai-shu*), first floor dwellings are even deprived of spacious private yard where they can do some gardening.

Circulation and Parking of Vehicles

Roads in the space between the buildings of each project are all paved and generally in good condition for bicycles. Being the lowest level of access road, they are usually between 2.5 to 3 meters wide, and cars cannot circulate easily, let alone park along them. Even though bicycles are the dominant mode of transportation, some projects don't provide enough bicycle storage space (table 5.3). Even in the project that has a bicycle garage, casual parking is not well organized in front of housing entries. Parking under a tree or in the small public lobby is preferred by people seeking convenience and a place to store their bicycles in case of rain.

Table 5.3 Functional Facilities for Vehicle Movement and Parking

	Fu-qiang-xi-li	En-ji-li	Xiao-hou-cang	Juer-Hutong	Ta-yuan	Huai-bai-shu
Paved access road	✓	✓	✓	✓	✓	✓
Bicycle garage	✓	✓	✓	✓	-	-
Car parking area	✓	★	-	-	-	-
Comparative overall evaluation	✓	★	✓	✓	-	-

★: good design ✓: average design -: bad design
Source: Visits to the projects.

Due to the fact that private car ownership is increasing, car parking in the residential area is becoming a new task for designers. In the case studies, two ways of providing parking are found in two projects. One of them locates a car park outside a housing entry, and the other one gives every space between buildings a small parking lot at the end of cul-de-sac. Small parking lots close to each building will increase resident access and allow their cars under surveillance. In all the projects, including the two which have parking areas, car parking inside the space between buildings is not regulated. Randomly parked cars

and bicycles sometimes block the road and encroach on the already less functional and cramped space.

5.4 Landscape Treatment of Space Between Buildings

Since it is not a profitable investment, the landscape treatment of space between buildings is basically kept as simple and practical as possible in terms of the materials selected and used in the design. However, to contribute to a successful site development in the long run, durability, safety, maintenance needs and long-term cost effectiveness must also be taken into account on top of the initial investment. Paving materials, walls and fences, site furniture and planting materials are to be discussed in the following sections.

Paving Materials

Table 5.4 Mostly Used Paving Materials

Paving Material	Appearance	Durability	Application	Cost	Maintenance
Concrete (or Aggregate Concrete)	good	excellent	entry path /parking area /sidewalk	low	low
Asphalt	average	average	vehicle road /parking area	low	average
Pre-cast Concrete Slabs	average	average	open space /walkway	average	average
Brick Pavers	excellent	good	open space /walkway	high	low

Source: Visits to the projects.

Concrete and asphalt are the materials used most often on roads and parking areas. Pre-cast concrete slabs and brick pavers are used on walkways and open spaces. The limited kinds of materials found in the case studies shows that there is not much diversity in the kinds of paving stones available (table 3.1). Nevertheless, the way in which these materials are used needs to be improved. First, the surface need not be colorless and dull. For example, the monotony of a long straight piece of pavement in front of the building can be broken up by continuing the entrance paths from front doors across to the other

side of the pavement; or a large open space can be enlivened with a pattern (as in *Juer hutong*). Second, a change of paving materials, patterns, colors and textures will help to distinguish areas used for different functions and activities. For example, the change from textured block paving to smooth asphalt emphasizes the change from pedestrian space to vehicular space; or a colored and patterned surfacing of a plain gray area may indicate the location of some special places such as housing entry.

Walls and Fences

Walls built with bricks are used to screen visual and acoustic intrusions and allow residents a high degree of privacy. They are primarily installed at the edges of public and semi-private or private domain, such as the private yard walls in *Fu-qiang-xi-li* or public courtyard walls in *Xiao-hou-cang*. Fences built from iron railings are more expensive than brick walls. They are used to deter trespassers and help maintain a relatively quiet, safe and well-defined territory in the space between buildings. They are usually installed along the edge of space between buildings.

Walls and fences have other uses than that need to be improved in the following ways. First, walls and fences should be kept as low and to make the areas they enclose as accessible as possible. If a wall is necessary, 1.8 meters (just a little higher than eye-level) is the maximum height of the solid part. Second, some dangerous places such as the electricity box, or the big hole on the roof of the bicycle garage in *Fu-qiang-xi-li*, etc., need to be enclosed in order to protect children. Third, some eyesores such as garbage tanks, outdoor storage piles in *Huai-bai-shu* and *Fu-qiang-xi-li*, etc., need to be screened, so as to maintain a pleasant aesthetic. Fourth, knee rails should be incorporated with other site furniture, like benches. The best fences are hedges or shrubs in *Xiao-hou-cang*, because they are natural and good for the environment.

Site Furniture

Some basic utilitarian site furnishings and accessories, such as light fixtures cannot be found in many of the projects. Spaces between buildings in *Fu-qiang-xi-li* and *Huai-bai-*

shu are very dim and with only the lights from dwellings to illuminate them at night. In fact, site lighting cannot be ignored in the site development because of the importance of its variety of functions, such as improving the nighttime visibility of signs, building numbers and oncoming vehicles, and illuminating outdoor steps and walkways. Benches are also important furnishings that offer residents the chance for passive recreation. These are not often present in the case studies either. They should be designed and located to face an interesting view whenever possible and to encourage both group socializing and privacy.

Planters or flowerbeds are the most common site furniture in each project. Depending on the maintenance level, they vary from luxuriant plantings (as in *En-ji-li*) to bare earth (as in *Huai-bai-shu*).

Plants

Grass is not widely used in the design and is only to be found in *En-ji-li* project. There are two reasons for this. First of all, grass is expensive in terms of initial cost and subsequent maintenance. Most of the projects still cannot afford this amenity. It is believed that grass is not easy to grow in Beijing where the climate is dry. Thus, some projects seek other alternatives. Since space between buildings in *Juer hutong* and *Xiao-hou-cang* are smaller in size, more private or semi-private spaces are created. This provides people with the opportunities to take care of plantings by themselves, and consequently reduces the maintenance cost that has been the burden of the government and/or the developer. In other cases like *Ta-yuan*, *Huai-bai-shu* and *Fu-qiang-xi-li*, there is just exposed earth and no turf on the ground of the designed grass area. Weeds are growing here and there and if left uncut, they will make the space between buildings look neglected.

Scholar-trees, poplars, willows, and pines are the most popular trees in Beijing. They are easy to grow, need almost no maintenance, and therefore are an efficient way of keeping the residential area green. Apart from the aesthetic and environmental value, trees also

have practical uses. People are used to hanging and airing clothes or quilts between trees. Big trees which offer large areas of shade in summer and don't block sunshine in winter should be put to the west of housing to ease the impact of the sun in the summer and screen wind in winter. The preservation of old trees needs to be considered in the new design as in Xiao-hou-cang and Juer hutong projects.

5.5 Conclusion

Mass produced apartment housing, either high-rise or medium-rise, is still the housing typology most in demand in Beijing. The space between buildings which is inherently associated with this type of housing affects not only the everyday life of millions of Beijingers, but also the image of this ancient city. As described in previous chapters, people tend to use these spaces more often compared to other kinds of outdoor space. Not only are these areas safe and secure to live in, but they are also more usable spaces for outdoor domestic work, they are pleasant and inviting for leisure time and good neighborhood communication. For the city, especially its central part where the urban renewal is in progress, space between buildings has a strong impact on the physical form of the urban environment. In the process of renewal, old hutongs and courtyard houses are transformed into new housing. If new designs fail to preserve the old neighborhood pattern, the image of this hundred-year old capital will gradually deteriorate.

The detailed analysis in this chapter has revealed some problems regarding the important issue of space between buildings, which needs to be solved. Both the government in terms of policy and practitioners in terms of design are responsible for finding these solutions.

Policy

On the policy side, there are still some clichés in most officers' minds in the municipality and planning administration bureaus. The influence of the former USSR and western "modern architecture" has been so deep-rooted that they have taken these planning and design approaches for granted. Since they are policy-makers, and in charge of reviewing

and approving projects, their ideas are implemented, even though some of them are badly conceived. There are three issues raised in this study which challenge the current planning policy on open space.

First, is the question of ***priority*** - **whether the development of the large-scale public open space is more important than that of the space just between buildings.** The large public open spaces which are expected to be the gathering places, usually sit empty and are seldom used by residents (like the green space in *Huai-bai-shu*, see figure 4.6.7). Because of strict zoning regulations, green areas are separated from the housing by streets. This makes access to these areas difficult. In fact, as described in section 3.4 of chapter 3, space between buildings is the more convenient place for people for leisure. People can casually go outdoors, rather than making a plan to meet there. Moreover, surveillance is easier when parents are close to home, and children can be called back for dinner from the apartment windows.

Another problem with large open spaces is that it is very difficult to maintain their appearance. It is very common for these areas to become less and less attractive quickly after their initial construction. Vandalism and lack of funds for their maintenance are the primary reasons for this. In the worse cases, there are neither grassy areas nor benches installed, leaving just bare earth in these large leftover spaces. However, open spaces divided into many small-scale spaces to serve a few families at a time, can make all the difference. As in some of the courtyards in the *Xiao-hou-cang* and *Juer hutong* projects, when fewer than ten households take control, they turn out to be more responsible, for example contributing voluntarily to the maintenance. It makes sense that if something belongs to everybody, then it belongs to nobody, and nobody will take care of it. From this point of view, small-scale open spaces will survive longer, and consequently will tend to be used more often than their larger counterparts.

Second, is the issue of the ***current residential planning policy*****, which doesn't encourage saving land, which is a valuable resource, considering the chronic**

shortage of land in China. Today, migration is no longer restricted by the government, and more and more people from rural areas and small cities come to big cities like Beijing to seek work and adventure. Beijing's total population had exceeded 11 million by the early 1990's (Beijing Statistics Bureau, 1993, p.27-29), a fact which has had a huge impact on land consumption for housing. Saving land should in fact be a fundamental policy to protect Beijing from urban sprawl. However, apart from these large open spaces discussed above, we can easily find many other areas of waste-land from case studies of other projects. Two examples are the almost 10-meters street front in many projects like *Fu-qiang-xi-li*; the corner of two perpendicular buildings in projects like *En-ji-li*; etc.. They are considered to be green land spaces, but like the large open space, when neglected, these areas look abandoned and remain unused. Although individually, they seem unimpressive in size, collectively these small patches of wasted land will comprise quite a large area.

The point is that every piece of land must be regarded as important, and usable. A solution to the problem of the small, neglected areas might be the following: if we could manage to cover these unused lands with houses, and lower the building height to maintain the FAR, the result would be a higher proportion of ground-related dwellings with private yards. As Nobert Schoenauer put it, "private patios and gardens at the base,... are most desirable and pleasant outdoor extensions of dwellings" (Schoenauer, 1994, p.141). If the building is four stories high, instead of six, one out of four households would have private yards in stead of one out of six, a 50 percent of increase. The advantage of this idea is that it benefits both residents and developers (the government in the case of public housing), killing two birds with one stone. In the transference from public to private control, more land will be usable, while expense on maintenance of public space is saved.

There is another potential way through which to save land. The north-south distance of space between buildings follows the sunlight regulation which is set to ensure sufficient ultraviolet from the sunlight in the south-facing rooms (see chapter 1). However, the best

way to receive ultraviolet rays is through direct exposure to the sunshine instead of through glass, which may result in losing much of ultraviolet rays. The effectiveness of this regulation is doubtful because it seems that more emphasis should be put on attracting people to outdoors, instead of assuming people stay at home to get sunshine, and leaving a large-scale space between buildings unused. Further study is needed to define what is the best ratio for distance/ building height, bearing in mind the combination of the health, land-efficiency, and architectural factors.

Third, **"The Standard Quota of Area for Public Service Facilities" ("Quota per Thousand People") should also regulate the amenities in spaces between buildings.** Minimum areas should be allocated for domestic tasks. Basic facilities like road lamps, benches, and children's playgrounds should be provided as mandatory norms. Exposed earth should be avoided for air quality and aesthetics reasons. If the future maintenance budget is expected to be low, more paving is a better option than exposed earth. In terms of parking, provide some designated parking spaces but don't let them dominate in this area, since priority should always be given to pedestrians in residential areas. Speed limits, curved roads and other vehicular control measures should be incorporated. In short, sensitive and balanced regulations will promote both the health and safety of the residents. "Relatively comfortable housing conditions" goals should be complemented by those for "Relatively comfortable outdoor living conditions".

Practicing

In practice, innovative designs which use the basic planning principles are still hard to find in China. Because of the necessity for the developers to achieve high FAR, and to receive approval as quickly as possible, the planning process becomes a mere numbers game, which makes it impossible to undertake research or to study alternative approaches. To change a situation like this, the Capital Planning Committee repeatedly called for improvement of residential planning (BURPC, 1995, p.4-7). In response, many of the projects are limited to adapting the housing style, rather than making a comprehensive design which takes into account the relation between buildings and

spaces. Nevertheless, *Xiao-hou-cang* and *Juer hutong* are two exceptions in the way they address the issue of open spaces.

There are two issues regarding open space design which needed to be stressed in this study: the definition of neighborhood, and the tradition of preservation.

First, **space between buildings, as the buffer zone between public and private, needs to be well defined in terms of boundary, scale, and contents, to create a good form of neighborhood**. The boundary has to be clearly marked to separate the housing neighborhood from public area, and access must be controlled so as to give a sense of belonging to residents, as well as a warning to intruders; the scale of space between buildings should be kept as small as possible to invite residents to participate and control what's going on in their realm; the more usable space, the better the outdoor domestic environment will function.

The scale of space between buildings is a major problem for a neighborhood. In the formal approach to housing, such as in the *Ta-yuan* project, there is simply no definition of neighborhood. In other cases like *Huai-bai-shu*, when there are too many households sharing one space between buildings, people find it difficult to develop social interaction because casual encounters rarely happen. The cramped staircases are the only places where socializing can take place, while space between buildings is used by many households from other staircases who might otherwise never meet. If the space between buildings is oversized, as in the 170 meter-long space in *Fu-qiang-xi-li*, people feel that the area is impersonal, and good neighbor relationship is difficult to develop. In contrast, in some small courtyards of *Xiao-hou-cang* and *Juer hutong*, natural surveillance and strong community relationships are made possible. Only in such areas are the well-developed neighborhoods to be found. It may be suggested that scaling down the size of space and neighborhood could remedy problems which arise due to the conventional approach.

Second, **traditional neighborhood patterns in terms of physical environment as well as social structure is a good point of reference for the new housing.** Hutongs and courtyard houses provide the basis for many historical discoveries, were conveyors of the traditional dwelling culture (Lian, 1995, p.116). What the conventional housing is missing can be found in here, as discussed in previous chapters. The need to preserve this culture is obvious; the question is how.

The well-functioning projects of *Xiao-hou-cang* and *Juer hutong* have shed some light on urban renewal problems. However, the limitations still exist within these two projects. The housing type is still the conventional apartment building which has no connection with Beijing at all, although the image of old hutongs and courtyards are preserved to some extent. It is hard to imagine that the ancient city image would be well preserved, if all the dilapidated courtyard houses were replaced by these typologies. These two projects should be seen as just the beginning. Further study is vital in order to find a form (or a series of forms) of housing that would be more compatible with old Beijing's traditional environment and way of life.

To summarize, the government and design and building practitioners have to recognize the importance of the potential of the space between buildings and put more emphasis on maximizing its use. The regulations should be modified to encourage a more innovative design approach. While "Relatively comfortable housing conditions" is one goal, relatively comfortable outdoor space should be the parallel goal. Only when more effort is made to create and maintain a better outdoor space, would the overall condition of the residential environment be improved and the quality of living conditions enhanced.

Bibliography

Abramson, Daniel Benjamin: "New Housing in Old Beijing: a Comparative Survey of Projects Completed to Date". *China City Planning Review*, Sept., 1994, pp.42-56.

Altman, Irwin and Martin M. Chemers. *Culture and Environment*. Monterey, California: Brooks/Cole Publishing Company, 1980.

Alexander, Christopher et al: *A Pattern Language*. New York: Oxford University Press, 1977.

Ashihara, Yoshinobu: *Exterior Design in Architecture*. New York: Van Nostrand Reinhold Company, 1970.

Bai, De-mao: *Residential Area Planning and Environment Design*. Beijing: China Building Industry Press, 1993. (In Chinese)

----------: "The Working Practice of Fu-qiang-xi-li". *Beijing Planning and Construction*, first issue, 1991, pp.41-45. (in Chinese)

----------: "Residential Environment". *Habitat International*, 1991, Vol.15, No.3, pp.139-141.

Beijing Statistic Bureau: *1993 Statistic Almanac of Beijing*. Beijing: China Statistic Press, 1993.

Beijing Survey and Design Administration: *A Selection of the Documents of Beijing's Housing Design. 1994*. Unpublished material. (in Chinese)

Beijing Municipal Urban Construction Comprehensive Development Office (BMUCCDO): *Design Collection of Small District and Residential District of Beijing, 1980-1989*. Unpublished material. (in Chinese)

Beijing Municipal Urban Construction Comprehensive Development Office (BMUCCDO): *Residential Construction in Beijing*. Beijing: China Building Industry Press, 1995.

Beijing Urban Renewal Head Office: *A Collection of Beijing's Urban Renewal Projects (I). Unpublished material. (in Chinese)*

Beijing Urban & Rural Planning Committee (BURPC): *Selected Documents of Beijing Residential Area Planning and Housing Design.* Exhibition material, 1995. (In Chinese)

Bhatt, Vikram et al: *Housing a Billion: Design Ideas for Rural China.* Montreal: McGill Press, 1993.

Blumenfeld, Hans. *The Modern Metropolis: Its Origins, Growth, Characteristics, and Planning.* Cambridge: The MIT Press, 1967.

Broudehoux, Anne-Marie: *Neighborhood Regeneration in Beijing.* Unpublished master's thesis in McGill University, Montreal, 1994.

Burby, Raymond J. & Shirley F. Weiss: *New Communities U.S.A..* Lexington: Lexington Books, 1976.

Canada Mortgage and Housing Corporation (CMHC): *Landscape Architectural Design and Maintenance.* Printed in Canada, 1982.

Chen, Guang-ting: "Urban Housing Problems in China". *China: the Challenge of Urban Housing.* Eds. Choko, Marc H. et al. Laval, PQ: Meridien, 1994, pp.13-37.

Chen, Ming: "Behavior Psychology and the Layout of Green Plots". *China City Planning Review,* June 1995, pp.35-39.

Chermayeff, Serge and Christophor Alexander. *Community and Privacy.* New York: Anchor Books Doubleday & Company, Inc., 1963.

County Council of Essex: *A Design Guide for Residential Areas.* Essex, Great Britain: Anchor Press Ltd, 1973.

Cullen, Gordon. *Townscape.* London: Architectural Press, 1961.

Curran, Raymond J. *Architecture and the Urban Experience.* New York: Van Nostrand Reinhold, 1983.

Davis, Deborah S. et al. (ed.): *Urban Spaces in Contemporary China.* New York: Woodrow Wilson Center Press, 1995.

Deng, Shu-ping and Zhong-gu Wang: *Reference Book of Residential Area Planning and Design.* Beijing: China Building Industry Press, 1996. (In Chinese)

Dong, Guang-qi: "The Retrospect and Perspective of Beijing's Old City Preservation and Renewal" (in Chinese). *Old City's Renewal.* Eds. IAUS (Institute of Architectural

and Urban Studies of Tsinghua University). Beijing: Tsinghua University Press, 1993.

Edit Committee of Beijing Construction History (ECBCH): *Reference Material of Beijing Urban Construction Since the Establishment of P.R. China.* Unpublished material. (In Chinese)

Ekblad, Solvig and Finn Werne: "Housing in Beijing." *Ekistics*, May/June 1990, pp.146-157.

Fan, Yao-bang: "The Existing Condition and Task of Urban Housing Problem in Beijing". *Beijing City Planning &Construction Review*, January, 1989, pp.30-33. (in Chinese)

Fong, Peter K.W.: "Housing Reforms in China". *Habitat International,* 1989, Vol.13, No.4, pp.29-41.

Fukushima, Masaharu. *An Analysis of the Transition Between Community and Privacy in Urban Housing.* Montreal: McGill Press, 1975.

Glendinning, Miles and Stefan Muthesius: *Tower Block.* New Haven and London: Yale University Press, 1994.

Great Britain Ministry of Housing and Local Government (GBMOHALG): *Landscaping for Flats* (Second Edition). London: Her Majesty's Stationery Office, 1967.

Guldin, Greg & Aidan Southall: *Urban Anthropology in China.* Leidon: E.J. Brill, 1993.

He, Hong-yu: "Living Conditions in Beijing's Courtyard Housing". *Building in China*, December, 1990, pp.14-20.

----------: "Social and Economic Aspects of Redevelopment Programs in Beijing Old City." *China: the Challenge of Urban Housing.* Eds. Choko, Marc H. et al. Laval, PQ: Meridien, 1994, pp.159-169.

Hester, Randolph T., Jr: *Neighborhood Space.* Stroudsburg: Dowden, Hutchinson & Ross Inc, 1975.

Huang, Hui: "Some Experience in the Xiao-hou-cang Project". *Architectural Journal*, July, 1991, pp.2-9. (in Chinese)

Huang, Hui, Chang-cun Guan & Jian Shi: "A New Way of Urban Renewal". *Beijing City Planning and Construction Review*, February, 1989, pp.21-23. (in Chinese)

Huang, Hui & Jian Shi: "Renovation Project of Dangerous Old Houses in Xiao-hou-cang Lane." *China City Planning Review*, June, 1991, pp.46-52.

Jankowiak, William R.: *Sex, Death, and Hierarchy in a Chinese City*. New York: Columbia University Press, 1993.

Jacobs, Jane: *The Death and Life of Great American Cities*. New York: Random House, 1961.

Jehl, Jan: *Life Between Buildings*. New York: Van Nostrand Reinhold, 1987.

Kirschenmann, Jorg C. and Christian Muschalek: *Residential Districts*. London: Granada, 1980.

Lang, Jon: *Creating Architectural theory*. New York: Van Nostrand Reinhold Company, 1987.

Leinwand, Stanley: *Creating Community in the Neighborhood Unit: An Evaluation of Alternative Approaches to the Urban Design-Social Interaction Paradigm*. Montreal: McGill University Press, 1994. (unpublished thesis)

Lennard, Suzanne H. Crowhurst & Henry L. Lennard: *Livable Cities*. Southampton, New York: Gondolier Press, 1987.

Lin, Lin: "Barrier-free Environments for the Elderly in Chinese Residential Areas". *China: the Challenge of Urban Housing*. Eds. Choko, Marc H. et al. Laval, PQ: Meridien, 1994, pp.197-213.

Lian, Zheng: *Housing Renewal in Beijing*. Unpublished master's thesis in McGill University, Montreal, 1995.

Liu, ke-yin et al: "The design of Huai-bai-shu project in Beijing". *Architectural Journal*, July, 1991, pp.8-13. (in Chinese)

Liu, Qi: "An Introduction to Beijing's Housing-Reform Program". *China: the Challenge of Urban Housing*. Eds. Choko, Marc H. et al. Laval, PQ: Meridien, 1994, pp.113-127.

Liu, Yang: "Environmental Aspects of Beijing's Old and Dilapidated Housing Renewal (Part 7)". *China City Planning Review*, vol.11, no.1, 1995, pp.45-55.

Loukaitou-Sideris, Anastasia. *Private Production of Public Open Space*. Los Angeles: University of Southern California Press, 1988.

Lozano, Eduardo E.: *Community Design and the Culture of Cities: the Cross road and the Wall.* Cambridge: Cambridge University Press, 1990.

Lucic, Katija. *Human Scale in the Urban Design of Montreal Residential Developments.* Unpublished master's thesis in McGill University, Montreal, 1995.

Lu, Jun-hua: "Beijing's Old and Dilapidated Housing Renewal (Part 1)". *China City Planning Review*, September, 1993, pp.42-54.

----------: "Beijing's Old and Dilapidated Housing Renewal (Part 2)". *China City Planning Review*, December, 1993, pp.42-54.

----------: "Beijing's Old and Dilapidated Housing Renewal (Part 3)". *China City Planning Review*, March, 1994, pp.42-54.

----------: "Beijing's Old and Dilapidated Housing Renewal (Part 4)". *China City Planning Review*, June, 1994, pp.42-54.

Lynch, Kevin: *The Image of the City.* Cambridge: The MIT Press, 1960.

----------: *A Theory of Good City Form.* Cambridge, Mass: MIT Press, 1980.

---------- and Gary Hack: *Site Planning.* Cambridge, Mass: MIT Press, 1984.

Ma, Laurence J.C. & Edward W. Hanten: *Urban Development in Modern China.* Boulder: Westview Press, 1985.

Macsai, John: *Housing.* New York: John Wiley & Sons, 1982.

Mao, Zi-yao & Guan-qian Zhao: *An Introduction to Housing Layout.* Nanjing: National Research Network of Urban Housing Design, 1988. (in Chinese)

Marcus, Clare Cooper & Carolyn Francis: People Places: Design Guidelines for Urban Open Space. New York: Van Nostrand Reinhold, 1998.

McQillan, Aidan: *Housing and Urban Development in China.* Washington: Office of Housing and Urban Program, USAID, 1984.

Ministry of Construction of P.R.China: *Code of Urban residential District Planning and Design.* Beijing: China Building Industry Press, 1993.

Murphey, Rhoads: *The Fading of the Maoist Vision: City and Country in China's Development.* New York: Methuen, 1980.

Newman, Oscar: *Defensible Space.* New York: The Macmillan Company, 1972.

Pilot Projects Office in Ministry of Construction of China: *The Second Batch of Pilot Projects of Residential Area Planning and Design in Urban China.* Beijing: China Construction Industry Press, 1993. (in Chinese)

Rahbar, Mehrdad: Privacy in Row Houses of Montreal. Unpublished master's thesis in McGill University, Montreal, 1996.

Rapoport, Amos: *Human Aspects of Urban Form.* Oxford: Pergamon Press, 1977.

Reuber, Paul: "Beijing's Hutongs and Siheyuan". *Canadian Architect*, Oct., 1998.

Seymour, Whitney North, Jr.: *Small Urban Spaces.* New York: New York University Press, 1969.

Schoenauer, Norbert: *History of Housing.* Montreal: McGill University, 1992.

----------: *Cities, Suburbs, Dwellings.* Montreal: McGill University, 1994.

Sit, Victor F. S.: *Beijing: the nature and Planning of a Chinese Capital City.* Chichester: John Wiley & Sons, 1995.

Sit, Victor F. S.: *Chinese Cities: the Growth of the Metropolis Since 1949.* Oxford: Oxford University Press, 1985.

Smith, Peter F. *Architecture and the Human Dimension.* Westfield, New Jersey: Eastview Editions, Inc., 1979.

Special Research Group (SRP): "A Survey of the Residents' Needs for Outdoor Activities". *China City Planning Review*, September, 1990, pp.39-59.

Untermann, Richard & Robert Small: *Site Planning for Cluster Housing.* New York: Van Nostrand Reinhold Company, 1977.

Venturi, Robert: *Complexity and Contradiction in Architecture.* New York: the Museum of Modern Art, 1966.

Walker, Theodore D.: *Site Design and Construction Detailing.* Mesa, Arizona: PDA Publishers, 1978.

Wang, Wei-hua & Ying-shi Tu: "People, Planning and Adaptability". *China City Planning Review*, June, 1990, pp.60-70.

Whyte, Martin King & William L. Parish: *Urban Life in Contemporary China.* Chicago: The University of Chicago Press, 1984.

Wu, Liang-Yong: *The Old City of Beijing and Its Juer Hutong Neighborhood.* Beijing: China Building Industry Press, 1994. (In Chinese)

Xie, Yi-Chun and Frank J. Costa: "Urban Design Practice in Socialist China". *Third World Planning Review*, 1991, 13(3), pp.277-296.

Ye, Mou-zhao: "Concept and practice of En-ji-li project." *Beijing Planning and Construction*, second issue 1991, pp.38-43. (in Chinese)

Zhao, Guan-qian: "People and the Living Environment: the Planning and Design Practice of National Pilot Projects". *Architectural Review*, Nov., 1994, pp.40-43. (in Chinese)

Zhou, Gan-zhi. "New Situation and Tasks for Urban Planning". *China City Planning Review*, June, 1994, pp.10-14.

Zhu, Jian-da: *Selected Projects of Contemporary Residential Area Planning.* Beijing: China Building Industry Press, 1996. (In Chinese)